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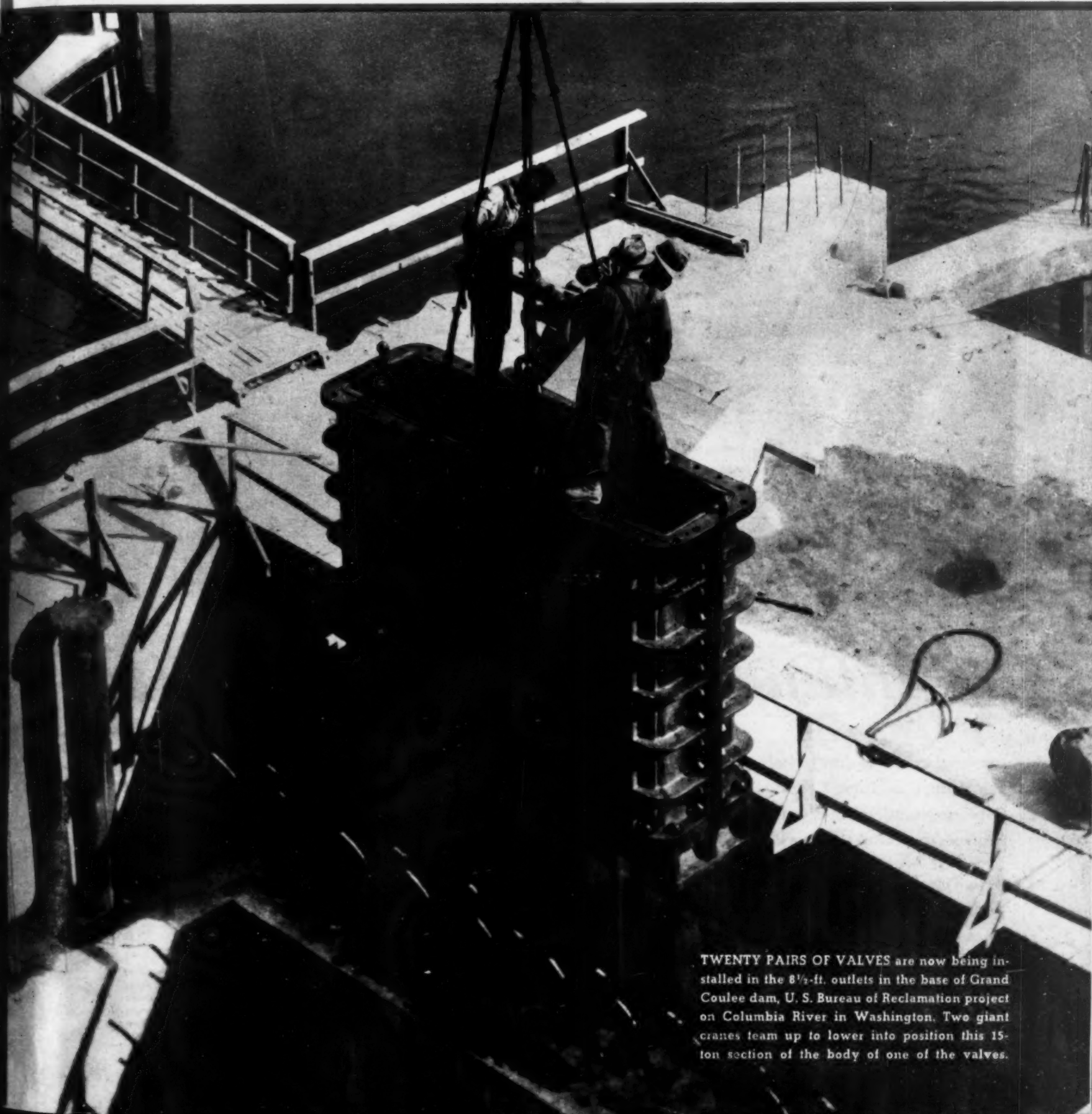
Construction

Methods and Equipment

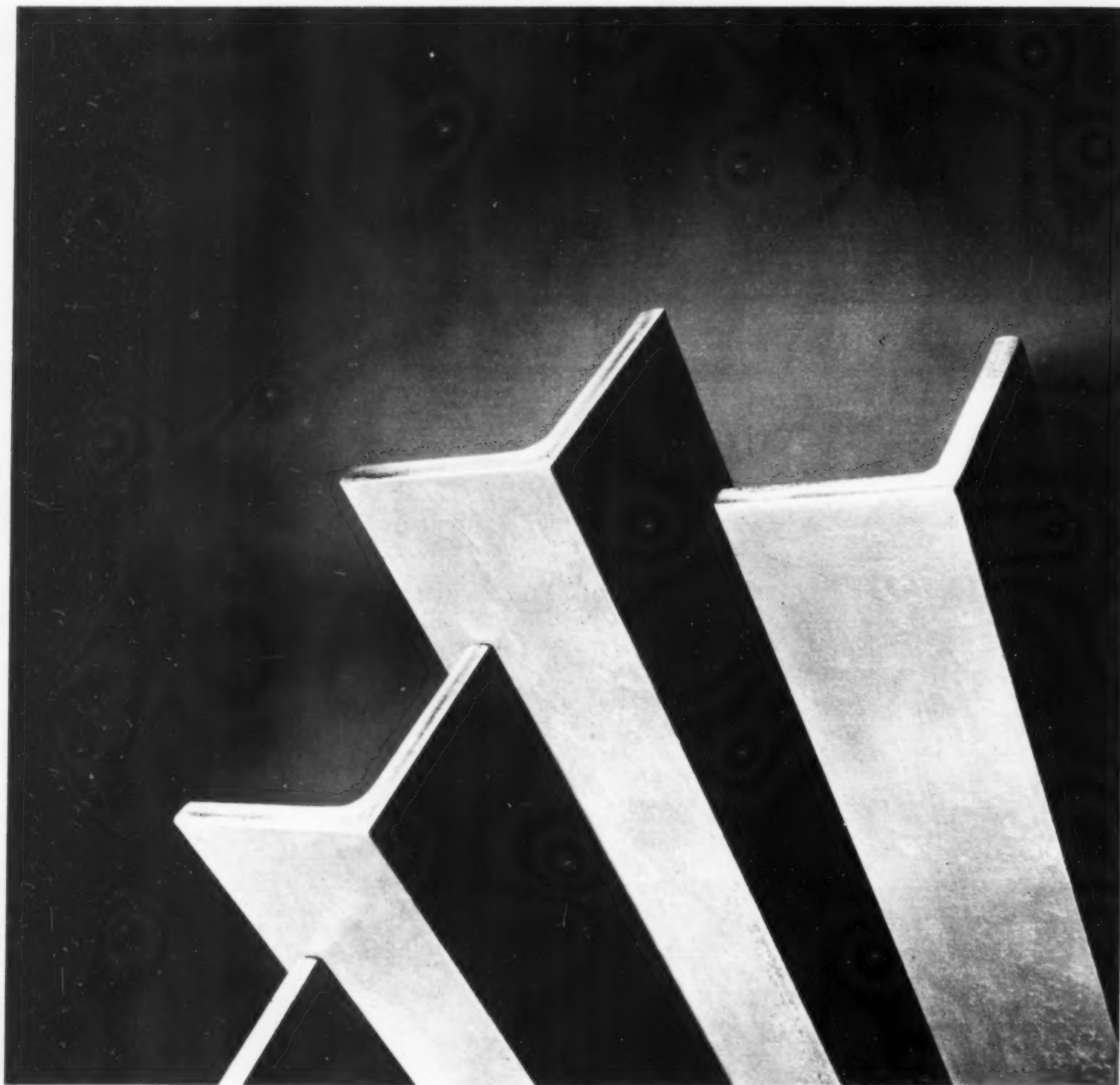
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June, 1938

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TWENTY PAIRS OF VALVES are now being installed in the 8½-ft. outlets in the base of Grand Coulee dam, U. S. Bureau of Reclamation project on Columbia River in Washington. Two giant cranes team up to lower into position this 15-ton section of the body of one of the valves.



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Personal co-operation has always been an outstanding feature of Inland service. Our field engineers have no standard method of procedure or limited routine to follow in working with you.

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SHEETS STRIP TIN PLATE BARS PLATES FLOOR PLATES
STRUCTURALS PILING RAILS TRACK ACCESSORIES REINFORCING BARS

CURRENT JOBS

... and Who's Doing Them

WATERWORKS

After a delay due to a taxpayer's suit claiming that scheduled wage rates were too high the Board of Water Supply of the City of New York awarded six contracts (5 for tunnels and 1 for stream diversion dam) totaling \$57,563,000, for sections of the Delaware River aqueduct, as follows: **S. A. Healy Co.**, Chicago, Ill., (two contracts) \$10,097,000 and \$10,985,000, respectively; **J. F. Shea Co.**, and **Henry J. Kaiser Co.**, Los Angeles, Calif., \$11,971,885; **Utah Construction Co.**, Ogden, Utah, \$10,829,530; **Seaboard Construction Co.**, New York City, \$10,810,167; **B. Perini & Sons, Inc.**, Framingham, Mass., \$2,869,390. In St. Paul, Minn., filtration plant extension contract went to **Okes Construction Co.**, of St. Paul, for \$404,404. With a bid of \$339,480 **Fred T. Ley & Co., Inc.**, of Springfield, Mass., obtained several waterworks pumping station jobs at Springfield, Mass. **Brandon & Reid**, of Grand Blanc, Mich., are installing a waterworks distribution system at Flint, Mich., for \$134,860.

BUILDINGS

Commercial—Housing development of 18 six-story apartments in Forest Hills, N. Y., costing \$2,500,000 went to **Patrick J. Dwyer & Sons**, of New York City. Another \$2,500,000 contract for an office building in Boston, Mass., was awarded to **Turner Construction Co.**, of Boston. In Linden, N. J., a \$1,250,000 apartment is being built by **Parklap National Builders, Inc.**, of New York City. **Hegeman-Harris Co.**,

Inc., of New York, received award for the \$1,000,000 Ford exhibit building at the World's Fair site in Flushing Meadow, N. Y. Work has been started by the **Tripp Construction Corp.**, of New York City, on a \$1,500,000 apartment in Cranford, N. J.

Industrial—Machine shop and office for Boston (Mass.) Elevated Railway, to cost \$1,500,000, was awarded to **C. J. Maney Co., Inc.**, of Boston. For Johns-Manville Corp., at Jarratt, Va., **Stone & Webster Engineering Corp.**, of Boston, has started work on a \$1,000,000 fibre board plant.

Public—At State College, Pa., **McCloskey & Co., Inc.**, of Philadelphia, received \$2,598,000 contract for several college buildings.

HIGHWAYS

Recent highway contract awards include the following—Tennessee: 3.2 mi. of paving in Scott County, \$176,874, to **Polk Smart Construction Co.**, of Chattanooga; 7.3 mi. regrading in Loudon and Knox Counties, \$476,027 to **MacDougal Construction Co.**, of Atlanta, Ga. New Jersey: 2.2 mi. of grading in Bergen County, \$320,403, to **Santaniello Bros.**, of Jersey City; 4.5 mi., Passaic County, \$165,567, to **Maxzoni Contracting Co.**, of New York City. Iowa: 7.4 mi., Crawford County, \$190,354, to **Booth & Olson**, of Sioux City; 7.6 mi., Sac County, \$172,578, to **Western Contracting Co.**, of Sioux City; California: 3.7 mi., Los Angeles County, \$348,498, to **Griffith Co.**, of Los Angeles; 9.7 mi., San Diego County, \$339,886, to **D. H. Ryan**, of San Diego.

The "How" of it

For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:

- How FREEZING OF GROUND prevented seepage at test shaft. — p. 33
- How FORM FABRICATION was systematized to cut costs. — p. 36
- How ERECTION MARKING on form panels gave location in structure. — p. 39
- How CONSTRUCTION HAULAGE COSTS were determined by field studies. — p. 42
- How PAVEMENT BREAKING was done with truck-mounted pneumatic hammer. — p. 43
- How HIGHWAY MAINTENANCE is made effective and economical by modern methods and machines. — p. 44
- How MULTI-PLATE PIPE was erected to form siphon 13 ft. 9 in. in diameter. — p. 48
- How STRUTTING was used to hold shape of big pipe prior to backfilling trench. — p. 49
- How CANAL LINING was formed by spraying bituminous mat on sides and bottom. — p. 52
- How STEEL SHEETPIILING was driven by mobile rig on truck chassis. — p. 52
- How AUTOMATIC BATCHING PLANT served mixer on bridge project. — p. 53
- How LIGHTWEIGHT CRANE was rigged as traveler to erect steel bridge. — p. 53
- How WOODEN HORSE was designed to be wobble-proof. — p. 53
- How SAND FOR ROAD MAINTENANCE was obtained by dredging with tractor-driven pump. — p. 55
- How WIRE FENCING, aggregating 154 mi. in length, was erected along line of aqueduct. — p. 56
- How POST HOLES for fencing were dug with mobile power auger. — p. 57
- How TALL ANTENNA, extending 625 ft. above ground, was erected with basket boom at radio station. — p. 58

Construction

Methods and Equipment

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WILLARD CHEVALIER, Vice-President

JUNE, 1938

ROBERT K. TOMLIN
Editor

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Editorial Staff: Vincent B. Smith, Paul Wooton (Washington),
Nelle Fitzgerald

New Mexico: In Torrance County, \$150,379, to **H. O. Peabody**, of Santa Fe. Kentucky: Four contracts, \$504,964, to **Perry McGlone Construction Co.**, of Kansas City, Mo. New York: 4.2 mi., Ulster County, \$351,700, to **A. E. Ottaviano, Inc.**, of Croton-on-Hudson, N. Y.; 9.9 mi. in Columbia County, \$367,514, to **Oneglia & Gervasini, Inc.**, of Torrington, Conn.; 8.7 mi., in Erie County, \$253,223, to **Holmes & Murphy**, of Orchard Park, N. Y.; 2.6 mi., Northern State Parkway, Nassau County, \$647,154, to **Andrew Weston Co., Inc.**, of Woodmere, N. Y.; 3.4 mi., Wantagh Parkway, Nassau County, \$864,640, to **Good Roads Engineering Co.**, of Lynbrook, N. Y.

DAMS AND WATERWAYS

Roller earth dam, to cost \$1,026,955, is under construction at Arkport, N. Y., by **E. J. Albrecht Co.**, of Chicago. On dredging contract in outer harbor at Ashtabula, Ohio, **Dunbar & Sullivan**, of Detroit, Mich., were low bidders with price of \$512,298. For a flood wall at Topeka, Kan., successful bidder, with price of \$181,818, was **J. A. Tobin Construction Co.**, of Kansas City, Mo. Outlet structures for Sardis dam, U. S. Engineer structure in Mississippi, were bid in for \$864,471 by **E. J. Albrecht Co.**, of Chicago. At Shasta dam, near Redding, Calif., diversion tunnel contract for \$426,475 was awarded to **Colonial Construction Co.**, of Spokane, Wash.

Biggest dam contract awarded last month was the Possum Kingdom dam on Brazos River, Tex., which went to **C. F. Lytle Co.**, of Sioux City, Ia., and **A. L. Johnson Construction Co.**, of Minneapolis, for \$3,287,303. In Utah, the Deer Creek dam, northeast of Provo, was awarded to **Rohl-Connolly Co.**, of Los Angeles, for \$2,189,097. At a price of \$509,690 to **A. C. Lee Construction Co.**, of Charlotte, N. C., obtained contract for earth dam on the Saluda River near Greenwood, S. C. Success-

ful bidder for earth and rockfill dams on Bitterroot River near Hamilton, Mont., was **F. J. Hass**, of Great Falls, Mont., with a price of \$396,996. Contract for the railroad relocation and river diversion tunnel for the Shasta dam, included in California's Central Valley project, was awarded to **Colonial Construction Co.**, of Spokane, Wash., for \$426,000.

BRIDGES

For substructure of Raritan River bridge in New Jersey, involving 10 river piers, low bid of \$1,157,657 was submitted by **P. F. Connolly Co.**, Long Island City, N. Y. **Tudike Corp.**, of Long Island City, N. Y., was low with price of \$372,000 for grading approach to Bronx-Whitestone bridge, New York City. For Main Ave. bridge in Cleveland, Ohio, awards for steel superstructure were made to **R. C. Mahon Co.**, of Detroit, for \$1,419,370 and for piers of substructure to **A. J. Forschner Co.**, of Cleveland, for \$309,569. To **Parker-Schram Co.**, of Portland, Ore., went \$229,823 contract for steel superstructure of Puget Island bridge across Columbia River in Washington. **Thomas McQueen Co.**, of Forest Park, Ill., bid \$219,486 for bridge over Little Calumet River, Chicago. In Cleveland, Ohio, **Lombardo Bros. Construction Co.** received a \$213,160 contract for Main Ave. bridge piers.

SEWERS

At Baltimore, **Virginia Engineering Co.**, of Newport News, Va., bid in for \$726,684 contract for Black River sewage treatment works. Intercepting sewers at College Point, New York, were awarded to **Luang Construction Co.**, of Brooklyn, for \$448,139. Construction of Spring Garden sewer, Pittsburgh, Pa., is under way by **Parkview Construction Co.**, of Pittsburgh, for \$255,008.

Are You Moving to a New Job?

Unlike workers in "indoor" industries, construction men don't stay put for any great length of time. There is an "outdoor" industry, requiring frequent moves from job to job, as one project is completed and another, hundreds or thousands of miles away, begins.

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Wisconsin Construction Looks at WPA.

SOME WEEKS AGO a group representing nearly forty organizations concerned with construction in Wisconsin, speaking as a "Statewide Construction Industry Conference",* issued a statement of its attitude with respect to the federal Works Progress Administration.

The group is noteworthy in that it includes so broad and diversified a cross-section of the construction activities of that state. Architects, engineers, contractors engaged in more than a dozen specialties, underwriters, material men and dealers, truckers and many more here unite in recognition of a common stake and a common concern in what may happen to their industry under the present trend.

Equally noteworthy is the statement issued by the group; because of its effort to offer constructive recommendations rather than merely to register objections. Doubtless construction men everywhere will read the objections and nod assent as they read. But it would be worth while for them to read also the entire list of recommendations.

Most radical of these is the proposal that "the President and Congress should demand that, for WPA, each industry work out ways to care for the temporarily unemployed in each industry with projects germane to the industry instead of dumping their unneeded employees on to relief at the invariable expense of the construction industry, as is done at present." In further detail, it is proposed that WPA should train the unemployed of each industry for those jobs in which shortages of competent men have developed, using the facilities of that industry and paying WPA wages. The Wisconsin Conference cannot see "why machinists and barbers should be trained to be bricklayers and carpenters."

Obviously practical difficulties lie in the path of such a program. But it must be equally obvious that any plan to establish a permanent WPA, as contemplated by Mr. Hopkins and his associates, must face those difficulties sooner or later. For if we take it for granted that a huge share of the unemployed, from whatever source, must be given relief jobs on public construction, private enterprise soon will be muscled out of the field and we shall have complete socialization of public construction. No one can

compute what that would cost the nation in the disintegration of a basic industry and in excessive construction costs.

MOREOVER, as suggested from time to time by this writer, the long-term answer to much of the unemployment problem must be sought in retraining those whose jobs have been obsoleted to fill the many new jobs created by technological progress. So why not begin now to formulate the cooperative effort between industry and government that is required to achieve such a solution? This voice from Wisconsin is but another reminder of the eventual need.

The conference has something to say also about allocating WPA funds. It proposes that federal funds be matched by the states, also that they be allocated to the states on some prescribed basis rather than to projects or districts by arbitrary discrimination. Every thoughtful person, whatever his politics, social status or economic need, must know that the unrestricted disbursement of public funds is very likely to be swayed by political fear or favor. Before such a hazard the foundations of democratic government cannot be secure. The blank check and the open political account are a combination that never should be entrusted to any political leader, however high-minded or humanitarian he may be.

THE RECOMMENDATIONS include several other constructive suggestions; and in their conclusions they embody the following:

"We concede the necessity for providing 'made-work' for a labor surplus consisting of the unskilled, chronic-relief, aged and physically defective workers, lacking a permanent place in industry.

"We do not concede the necessity for 'made-work' confined to the construction industry for all able-bodied and trained workers from *all* industries who may temporarily be unemployed."

All in all, the Wisconsin Conference sets forth the case for the construction industry reasonably and realistically. Their statement deserves thoughtful consideration by all concerned.

Willard Chevalier

* Rooms 407-409 Commerce Bldg.
744 North 4th Street
Milwaukee, Wisconsin

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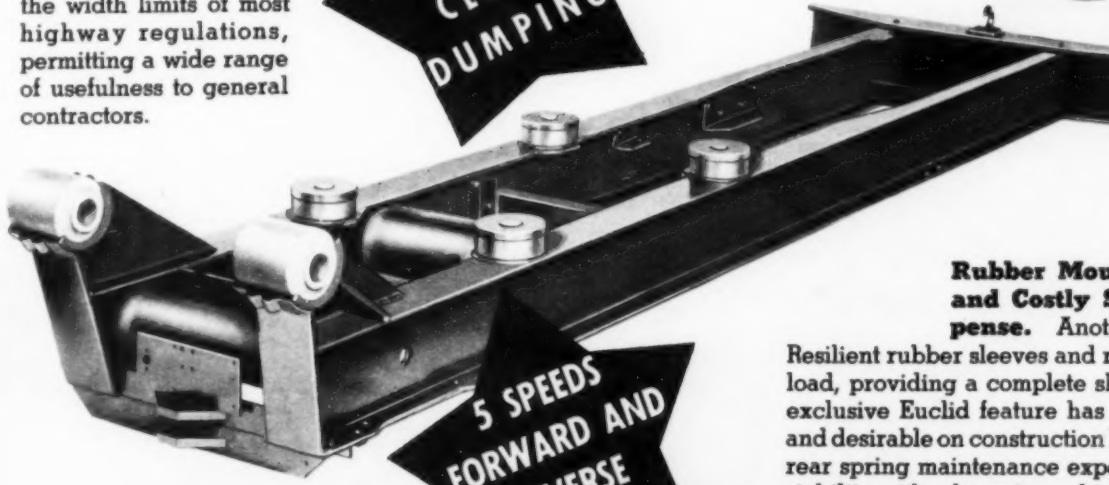
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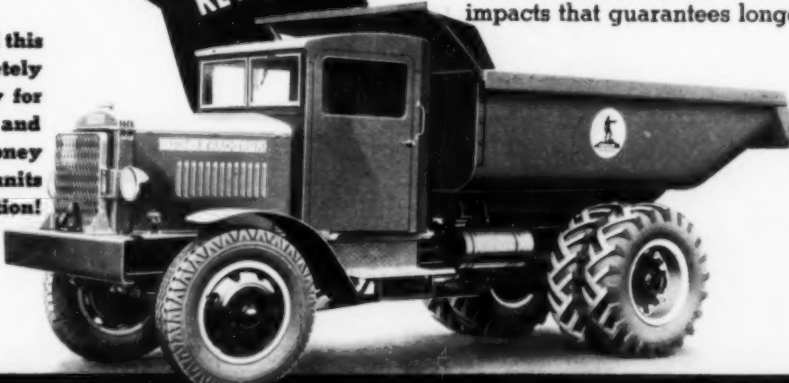


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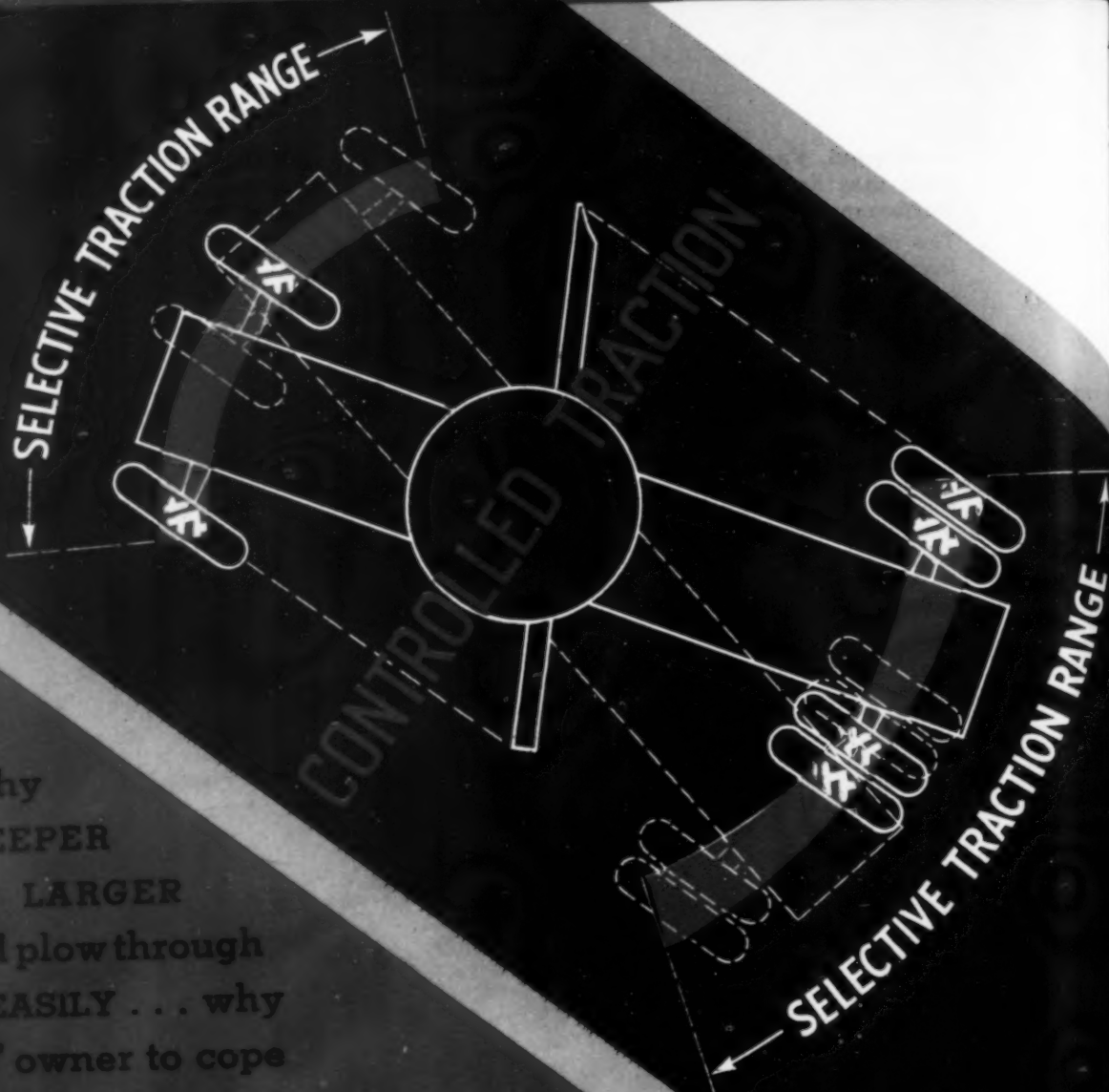
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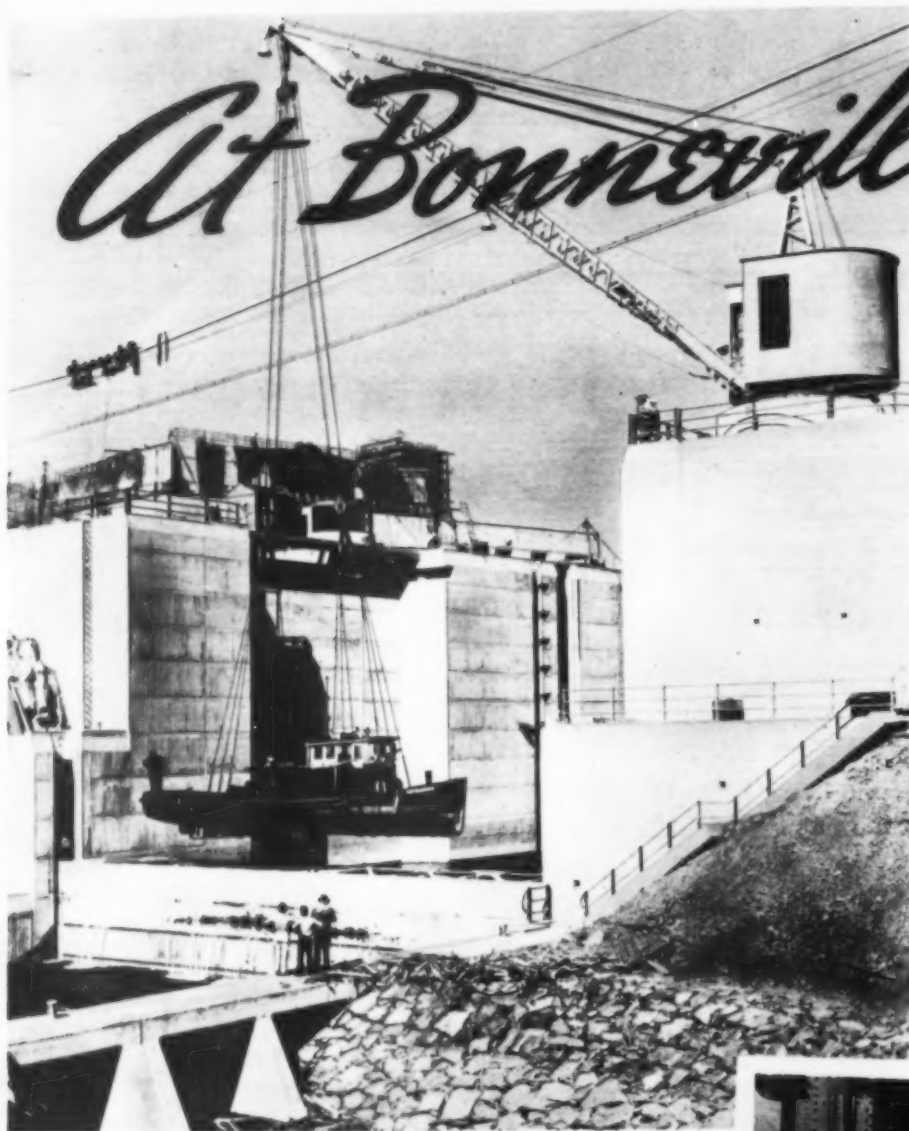
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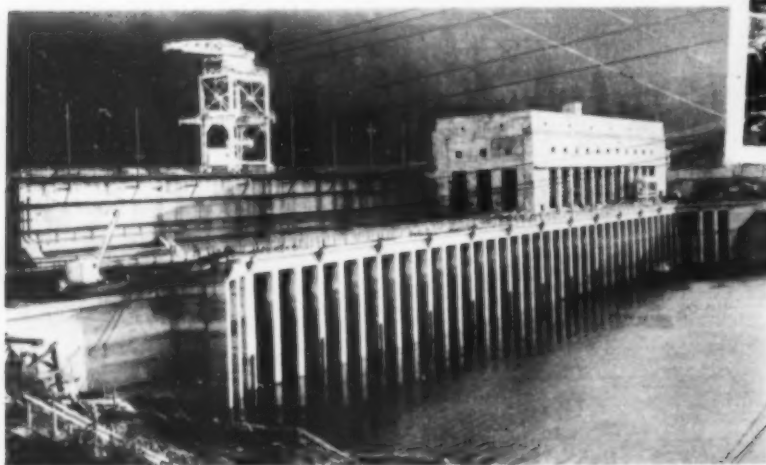
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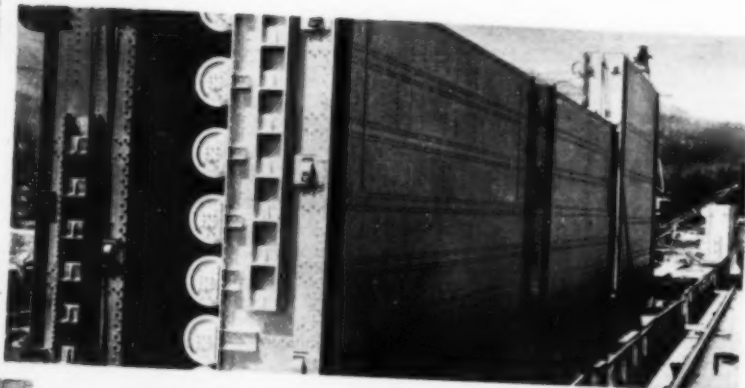
ILLINOIS



Crane lifting towboat over temporary bulkhead pending completion of lock which will handle ocean-going vessels.



View of power house which will have, ultimately, a capacity of 430,000 kw.



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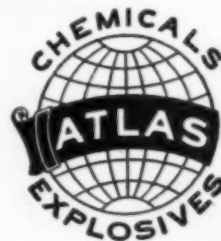
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LINK-BELT

Speed-o-Matic

SHOVEL DRAGLINE - CRANE

Oceans built



TAKE 'ER AWAY! Some of the 140,000 yards of earth—and 30,000 yards of rock—that had to be moved at Cabin John. It's going along the quarter-mile haul.

LET 'ER GO! Part of the rock and earth moved for Potts & Callahan by their "Caterpillar" Diesel Tractors at Cabin John.

• Miniature ships, in miniature storms . . . on a miniature sea at Cabin John, Maryland! That is the result of the Potts & Callahan contract which called for excavating 140,000 yards of earth—and 30,000 yards of rock—to make the world's most up-to-date ship-model testing basin.

Potts & Callahan, of course, wanted to get the job done on time—and done at the lowest possible cost. So you would naturally expect to find exactly what is pictured here. For when savings . . . speed . . . and hard work must be combined, *the logical choice of power* is "Caterpillar" Diesel!

Here is fuel-economy that makes the most of the lowest priced fuels . . . ground-gripping traction and pull to move the heavy loads over rock, in mud, or on soft earth . . . strength in steel and design to hold down your maintenance-costs!

BACK FOR ANOTHER! Not much time lost between dump and shovel, when you get "Caterpillar" Diesel Tractors shuttling back and forth!



to order!



FILL 'ER UP! Athey wagons, in tandem, pulled by a "Caterpillar" Diesel D8 Tractor at Cabin John, Maryland—excavating for the world's most up-to-date ship-model testing basin; an ocean built to order! Working 8 hours a day, this tractor uses but 30 gallons of 6½¢ fuel. But that's not the only economy here! With the responsiveness of a "Caterpillar" Diesel, the operator doesn't waste any time spotting under the shovel!

SCRAPE IT UP! "Caterpillar" Diesel D8 and LeTourneau carryall owned by Potts & Callahan of Baltimore, Maryland—also working on the excavation for the ship-model testing basin.



CATERPILLAR

TRACTOR CO.
PEORIA, ILL.

DIESEL ENGINES • TRACK-TYPE TRACTORS • ROAD MACHINERY

RPM
REG. U.S. PAT. OFF.
**DIESEL ENGINE
LUBRICATING OIL**

...at work

**More "RPM" Diesel Engine Lubricating Oil
is being sold and used in "Caterpillar" Diesel
Engines than all other Diesel oils combined!**

In all parts of the world, this great oil makes friends on every job it
tackles! E. A. Parsen, General Contractor, Las Vegas, Nevada, reports:

"We have been using your 'RPM' Diesel Engine Lubricating Oil for
the past six months under the most adverse conditions and as yet we
have lost no time due to stuck rings or any other lubricating failure.
"Conditions here have assured us that your oil will stand the supreme
test and give perfect lubrication at all times and under all conditions..."

Yours truly,

(Signed) E. A. PARSEN

"RPM" Diesel Engine Lubricating Oil is distributed by the follow-
ing companies under the brand names indicated:

IN THE UNITED STATES

"RPM" Diesel Engine Lubricating Oil:

THE CALIFORNIA COMPANY (Montana only)
THE CARTER OIL COMPANY, Tulsa, Oklahoma
HUMBLE OIL & REFINING COMPANY
STANDARD OIL COMPANY (Indiana)
STANDARD OIL COMPANY (Inc. in Kentucky)
STANDARD OIL COMPANY (Nebraska)
STANDARD OIL COMPANY OF CALIFORNIA
STANDARD OIL COMPANY OF TEXAS
UTAH OIL REFINING COMPANY

Signal "RPM" Diesel Engine Lubricating Oil:
SIGNAL OIL COMPANY

Diol "RPM" Diesel Engine Lubricating Oil:

COLONIAL BEACON OIL COMPANY, INC.
STANDARD OIL COMPANY OF LOUISIANA
STANDARD OIL COMPANY OF NEW JERSEY
STANDARD OIL COMPANY OF PENNSYLVANIA

Sohio "RPM" Diesel Engine Lubricating Oil:
THE STANDARD OIL COMPANY (Ohio)

IN CANADA

"RPM" Diesel Engine Lubricating Oil:

IMPERIAL OIL LIMITED
STANDARD OIL COMPANY OF BRITISH COLUMBIA
LIMITED

THROUGHOUT THE WORLD

"RPM" Diesel Engine Lubricating Oil is also available through
distributors in more than 100 other countries.

STANDARD OIL COMPANY OF

making FRIENDS!



RPM
REG. U.S. PAT. OFF.
**DIESEL ENGINE
LUBRICATING OIL**

F CALIFORNIA

Approved by
CATERPILLAR TRACTOR CO.

LARGE CAPACITY *Means..* *Lower Cost Per Yard For Hauling*

LAPLANT-CHOATE RUBBER WHEELED WAGONS

Here's the modern way to keep your hauling costs low on any kind of a job. Modernize your equipment with large capacity LaPlant-Choate Rubber Wheeled Wagons and regardless of the weather or ground conditions, you can haul more material per load and carry more loads per day. These hydraulically operated wagons roll easily on any surface, make short turns and are remarkably free from upkeep and repair costs. The hydraulically operated dump doors are hinged on the outside, thus leaving the inside surface free from any obstructions. Even the stickiest loads can be dumped instantly and completely. Be sure to get full details on these outstanding dump wagons right away.

LAPLANT-CHOATE
Lower Costs



19 YARD Capacity
Also Available in 13 Yard Size

LaPlant-Choate Rubber Wheeled Wagons are available in both 19-yard and 13-yard sizes. These outstanding units are designed exclusively for use with "Caterpillar" track-type tractors. This assures quick and competent service from any of the hundreds of "Caterpillar" dealers throughout the country.

Get full details from your nearest
"Caterpillar" dealer. Write today
for free circular.

BULLDOZERS
ROAD SCRAPERS
SNOW PLOWS

LA PLANT-CHOATE
MANUFACTURING CO. Inc
CEDAR RAPIDS, IOWA.

TRAIL BUILDERS
BRUSH CUTTERS
TAMPING ROLLERS

SOLID ROCK MOVED DIRT CHEAP



We'll never again tell an experienced LeTourneau user that a job is too tough to handle with Scrapers. Good as we knew LeTourneau equipment to be — from design, right down through the final assembly — Fred Kutzke's amazing story caught us (along with most contractors) with our mouths wide open. Most of his job is solid rock!

While other contractors bidding the Blue Mounds (Wisconsin) highway job on U. S. Route 18, figured on a basis of trucks, shovels and plenty of dynamite, Fred Kutzke & Co. said, "Boys, we'll make a profit on this with LeTourneau Carryall Scrapers, a Heavy Duty Rooter and an Angledozer." That, aside from a compressor and a few jackhammers, is all the equipment represented on this 350,000 cu. yd. cut and fill job.

Most of the formations must be shot; even so, the Rooter is saving many blasting dollars by breaking the larger chunks for fast Carryall loading. Some rock is broken entirely with the Rooter, which gives perfect Carryall breakage wherever the teeth will penetrate. As for the Carryall Scrapers, they're getting good average pay loads with blades that have seen as much as 700 hours service.

Like Fred Kutzke's competitors, some day you'll run into a tough job that you hadn't counted on. Will you be forced to stand by, wondering where your costly methods can be used? Or, will the scrapers you bought after tests in "ordinary" dirt stand the punishment LeTourneau Carryalls have gone through time after time . . . and come out on the profit side? Remember, if your Scrapers will produce profits in rock, you need never worry about profits in dirt . . . sand . . . gravel . . . mud . . . gumbo . . . shale.

Ask your "Caterpillar" dealer today for a LeTourneau demonstration . . . if you want to be in the profits tomorrow.

LETOURNEAU

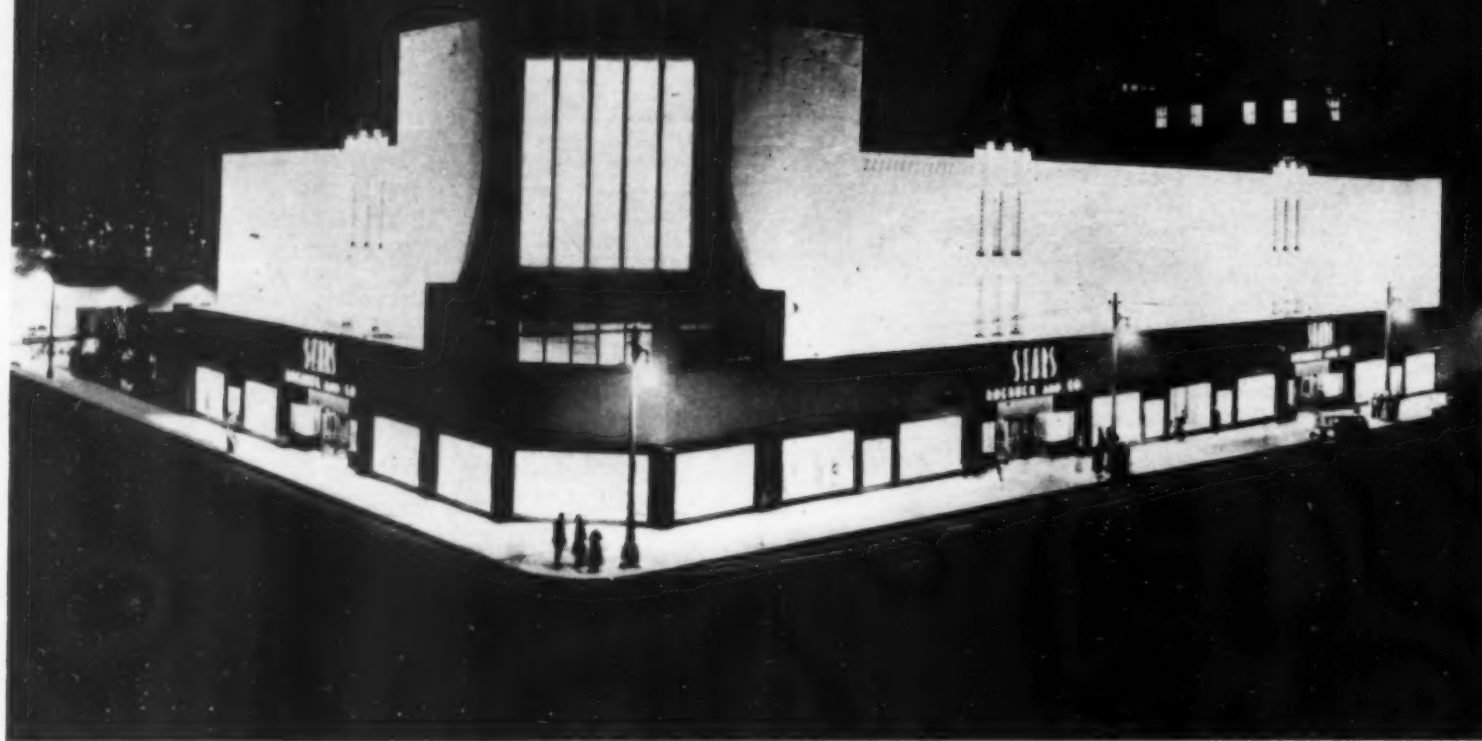
R. G. LeTOURNEAU, INC., • Peoria, Illinois • Stockton, California • Cable Address: "Bobletorno"

Manufacturers of: Angledozer*, Buggies*, Bulldozers, Carryall* Scrapers, Cranes, Drag Scrapers, Power Control Units, Rooters*, Treedozer.

*Name Registered U. S. Patent Office.

ARCHITECTURAL CONCRETE

jobs coming thick and fast!



The recently completed Sears, Roebuck Building at Highland Park, Michigan, is another example of beauty and quality resulting from fine formwork and rigid control of concrete mixture design and placement. Nimmons, Carr & Wright, Chicago, were the architects; Patterson Engineering Co. of Detroit, contractor. Other Architectural Concrete buildings for Sears, Roebuck are under construction or have recently been completed at Baltimore, Chicago and Glendale, Calif.

PATTERSON ENGINEERING CO. of Detroit, contractor for the building shown above, is among the many firms who now "have the hang" of this fast-growing type of construction.

A record number of stores, factories, schools, theaters and other building jobs currently are being designed and let for Architectural Concrete. It's the low cost way to erect beautiful, firesafe, enduring buildings.

What's the procedure? Walls are cast

as a unit with frame and floors — ornament and wall texture created through form refinements. Uniformly dense, water-tight concrete is of course required.

Recommended forming practice is covered in the free manual, "Forms for Architectural Concrete." May we send you a copy?

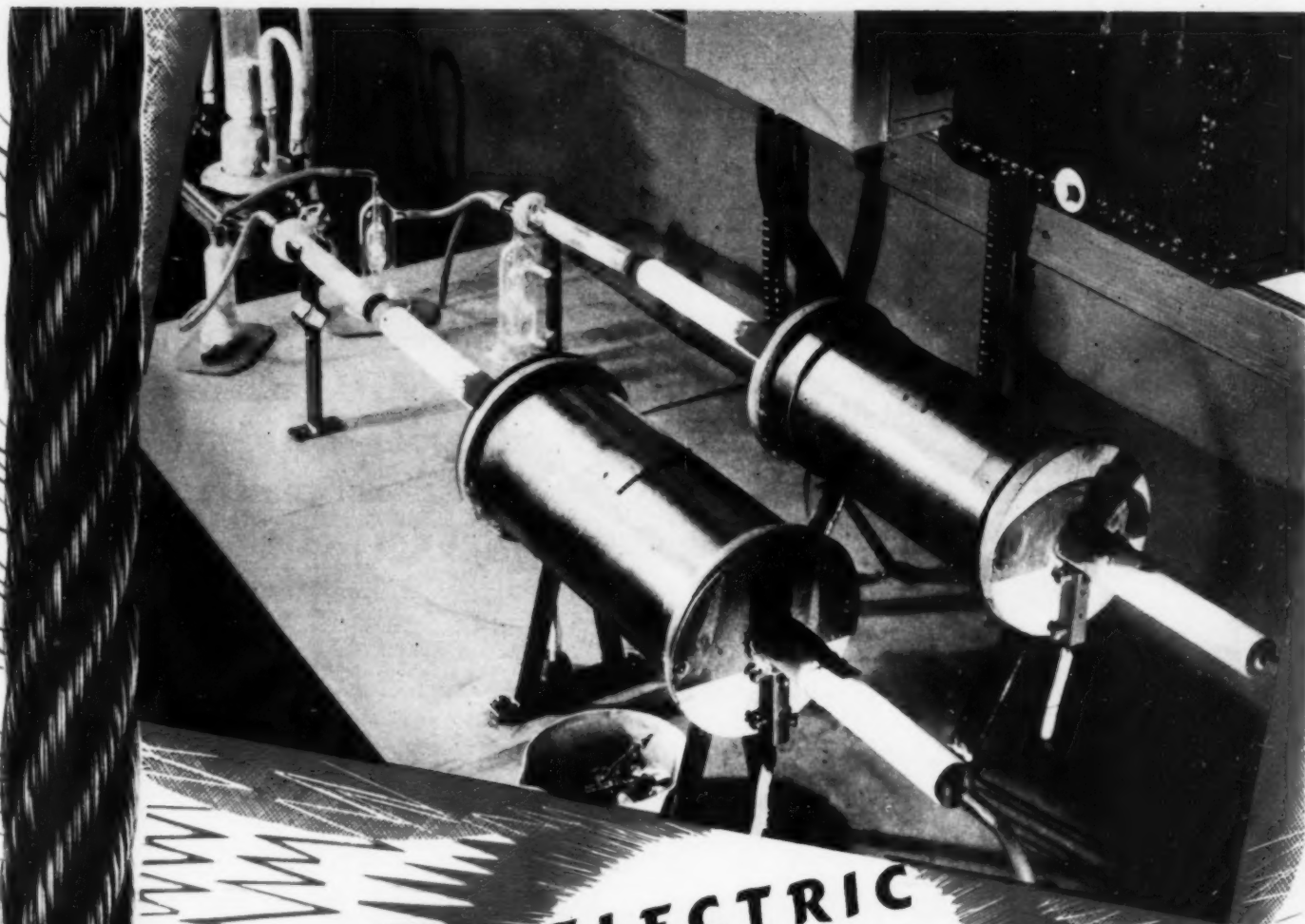
PORTLAND CEMENT ASSOCIATION

Dept. A6-16, 33 W. Grand Ave., Chicago, Ill.

*A National Organization to Improve
and Extend the Uses of Concrete*

Architectural Concrete

Walls and Ornament Cast Integral with Frame and Floors



ELECTRIC INFERNOS BURN STEEL SAMPLES

IN BUILDING WICKWIRE ROPE LIFE "BEYOND SPECIFICATIONS"

The carbon content of every pound of steel that goes into the wire for making wire rope, must be exact to produce the uniformly high degree of tensile strength, hardness and bending fatigue resistance that gives rope longer life. When testing for carbon in the Wickwire Spencer laboratories, the steel is burned in an atmosphere of oxygen. Resultant gases are segregated, captured, weighed and compared to find the percentage of carbon present. This is only one of the many painstaking and costly steps in producing Wickwire Spencer Wire Rope . . . beyond specifications. Official Specifications only set minimum physical standards. It is still the privilege of the progressive rope manufacturer to build life beyond specifications into his product.

WICKWIRE SPENCER STEEL COMPANY

General Offices: 41 East 42nd Street, New York City; Sales Offices and Warehouses: Worcester, New York, Chicago, Buffalo, San Francisco, Los Angeles; Export Sales Dept.: New York City. WICKWIRE SPENCER SALES CORPORATION, New York, Chattanooga, Tulsa, Abilene, Texas, Portland, Seattle.

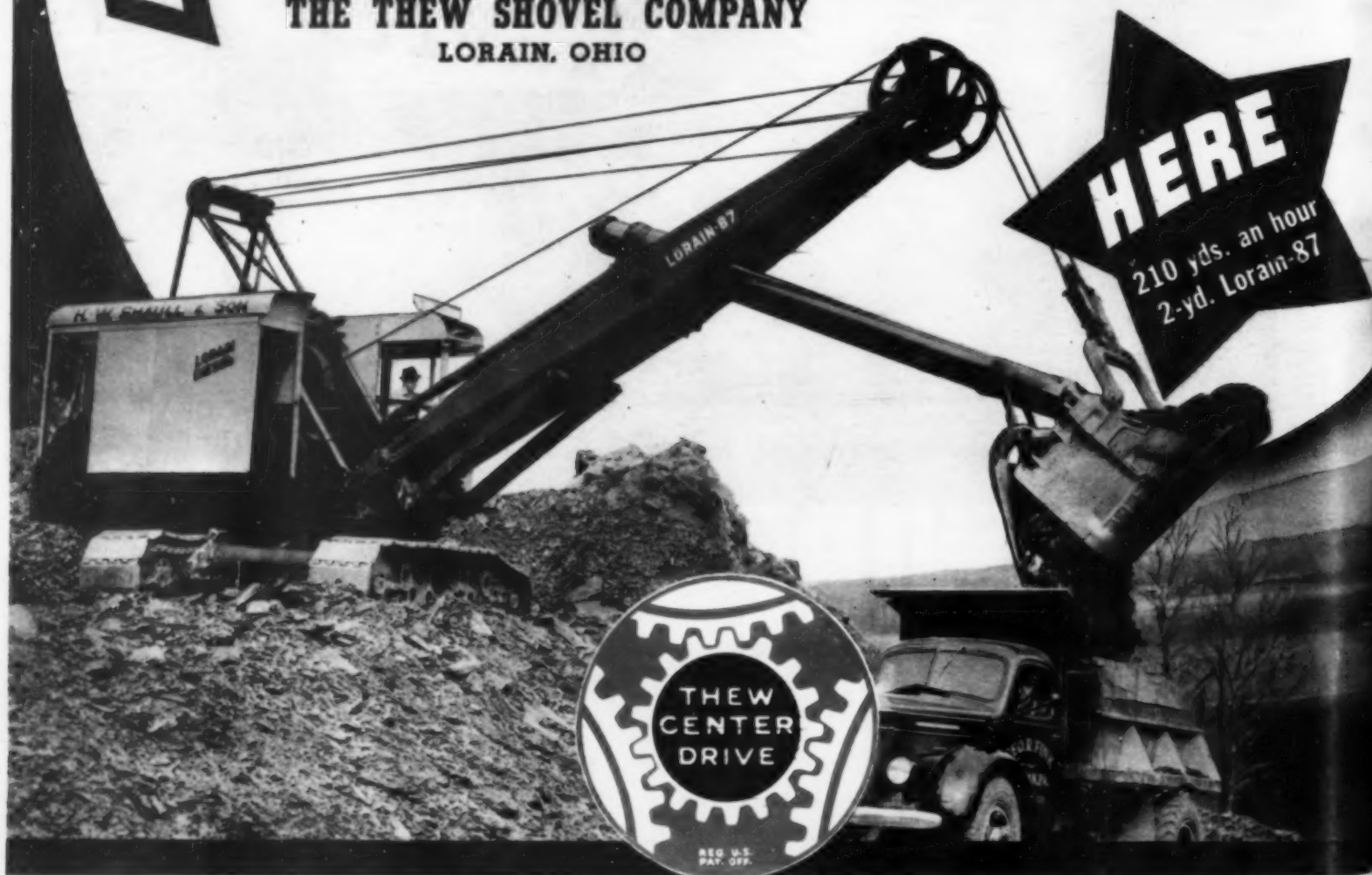
WICKWIRE ROPE

LOW DIRT MOVING COSTS START

It's the speed with which a shovel gets dirt into the dipper and out again that determines the profit spread between your bid and cost prices. The one purpose of all Lorain design and construction features is to provide the power and strength required to maintain this digging cycle at highest possible speeds.

That's why America's most successful contractors continue to specify Lorains for those tough dirt-moving jobs. Where, how, and why certain metals, gears, and gadgets are used are incidental to these users compared to the fact that Lorains keep their costs low and their profits high.

THE THEW SHOVEL COMPANY
LORAIN, OHIO





HERE

100 yds. an hour
3/4-yd. Lorain-40

HERE

Digs 2
basements a day
3/4-yd. Lorain-40
Backdigger

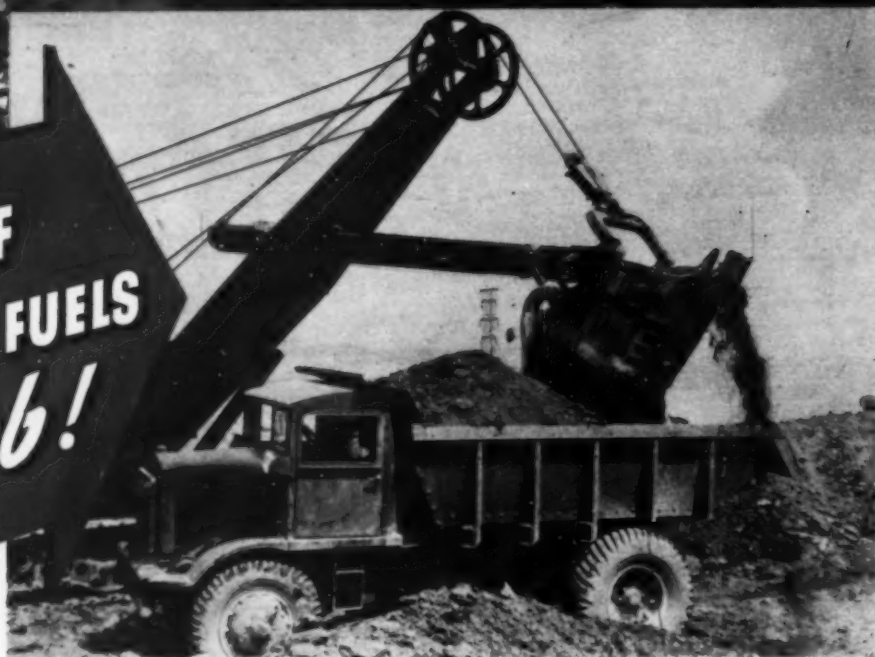
LORAINS
3/8 TO 2 1/2 YDS.

FRED SCHWALLER

THEY MOVE IT *at a profit...*



...with **GULF**
LUBRICANTS AND FUELS
on the job!



"**W**E'VE made the dirt fly on this job—without troublesome delays or costly repairs for our equipment," says this contractor. "Gulf's higher quality lubricants help us move dirt at a profit."

You get these three big advantages when you use Gulf products: First, an experienced Gulf engineer recommends, on the job, the proper oils and greases for each requirement. Second, you're *sure* of getting lubricants exactly suited to your equipment—because the Gulf line includes several hundred different brands of oils and greases. Third, when you order Gulf lubricants you get them promptly. Gulf's wide distribution

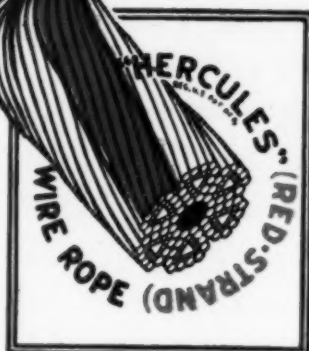
from Maine to Texas assures prompt delivery to every customer, no matter how remote the job.

Let a Gulf engineer point out to you the possibilities for improvement in the lubrication of the equipment you are now operating. He can help you finish your job *with a bigger profit*. Gulf Oil Corporation—Gulf Refining Company, Gulf Building, Pittsburgh, Pa.



Durability

Plus
STRENGTH
ELASTICITY
FLEXIBILITY
TOUGHNESS

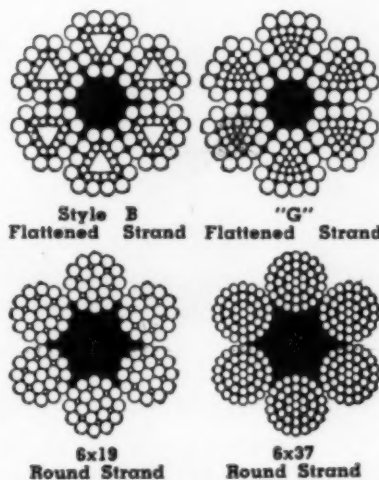


Available in both
Round Strand and
Flattened Strand
constructions —
either Standard or
Preformed.

All Perfectly BALANCED

Durability means long life. In Wire Rope it means the ability to resist the wear and tear that wire rope encounters in service.

"HERCULES" (Red-Strand) Wire Rope has maximum durability because the vital factors to produce long life are built into it in balanced proportion. Strength . . . toughness . . . elasticity and flexi-



bility, all perfectly balanced in "HERCULES" (Red-Strand) produce that fifth vital characteristic of durability.

It is the presence of all the essential factors in every length of "HERCULES" (Red-Strand) Wire Rope that makes it perform better and last longer. Your own cost charts will show you how big the difference is.

If you will tell us how you use wire rope, we shall be glad to suggest the construction we consider best for your particular conditions.

MADE ONLY BY

A. Leschen & Sons Rope Co.

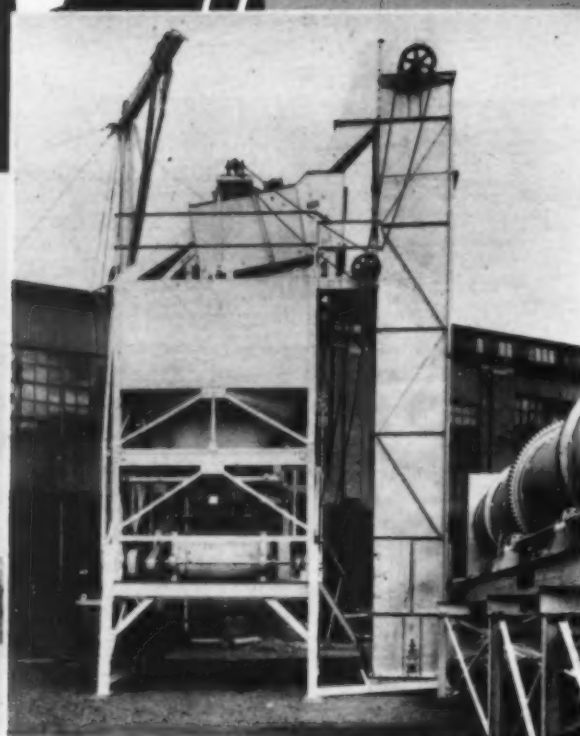
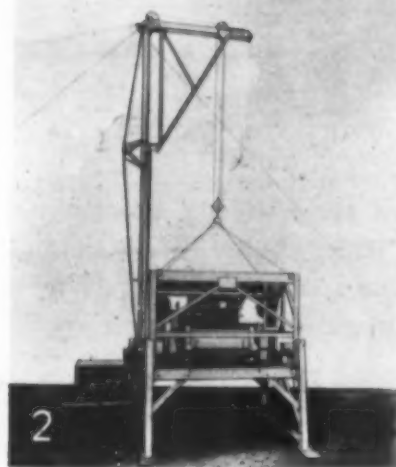
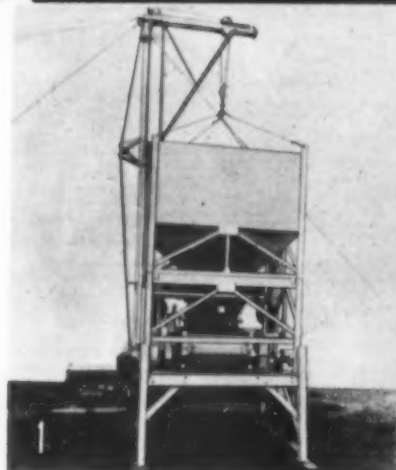
ESTABLISHED 1857

5909 Kennerly Avenue, St. Louis, Mo.

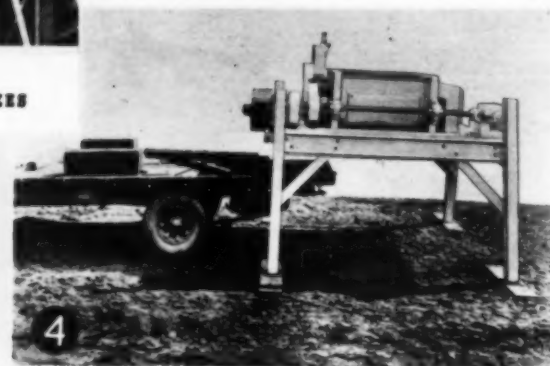
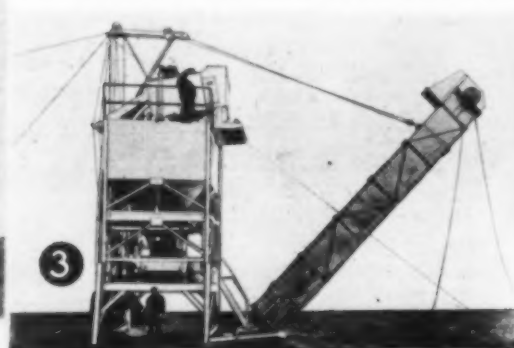
New York.....90 West Street
Chicago.....810 W. Washington Blvd.
Denver.....1554 Wazee Street

San Francisco.....520 Fourth Street
Portland.....914 N. W. 14th Avenue
Seattle.....3410 First Avenue South

Now *for the* FIRST TIME



MODEL P-A PLANTS ARE BUILT IN 4 SIZES



- ① MODEL PA-30 — 3000 # Mixer
- ② MODEL PA-20 — 2000 # Mixer
- ③ MODEL PA-40 — 4000 # Mixer
- ④ MODEL PA-15 — 1500 # Mixer

With all latest improved features of H&B design.

All comply with State Highway and Federal Roads Specifications.

Large Capacity Portable Asphalt Plants Built in Complete Sectional Units

Capital Investment in Tires & Running Gear Avoided—Units of These Plants are each Complete and Self-Contained and can be Transported on Standard Hauling Equipment—Comply with Most Highway Loading & Road Clearance Regulations.

THE MOST EFFICIENT AND ECONOMICAL PORTABLE PLANT BUILT — LARGE CAPACITY — RIGID CONSTRUCTION

Write for Bulletin T-260
Patents applied for.

HETHERINGTON & BERNER INC.

ENGINEERS - MANUFACTURERS

701-745 Kentucky Ave., Indianapolis, Ind.

NOTICE TO BIDDERS!

It's hard to figure against the contractor who uses Cummins Diesel power. His savings in truck operations alone mean a big difference in his costs.

Play safe when you bid. Figure in the dependability, proved performance and economy of the Cummins Diesel. It means your job will be "Powered for Profit."

CUMMINS ENGINE CO., 1908 Wilson St., Columbus, Indiana

The 26 "Euclids" on this dirt moving job are "Powered for Profit" by Cummins Dependable Diesels.

CUMMINS
Dependable
DIESEL

PIONEER IN MODERN DIESEL DEVELOPMENT

These prominent manufacturers offer new trucks powered with Cummins Diesels — Autocar Company; Available Truck Company; Dart Truck Company; Euclid Road Machinery Co.; Fageol Truck & Coach Co.; Four Wheel Drive Auto Co.; Hug Company; International Harvester Company; Kenworth Motor Truck Corp.; Linn Mfg. Company; Mack Mfg. Company; Marmon-Harrington Co.; Mereland Motor Truck Co.; Oshkosh Motor Truck Company; Sterling Motor Truck Co.; Walter Motor Truck Company; Ward-Lafayette Truck Co.; White Motor Truck Company; Hendrickson Motor Truck Company; and The Corbitt Company.

Oshkosh



SPEED UP TO 35 MILES PER HOUR • SPECIAL HIGH SPEED CABLE WINCH

YOU MEN experienced in the field know that the cost of moving dirt up to the present time has been far in excess of what it ought to be. Consequently, Oshkosh Motor Truck, Inc. and Southwest Welding and Manufacturing Company, Inc. recently pooled their resources and engineering experience to develop equipment which would consid-

erably lower dirt moving costs. The results are revolutionary. By combining the *fast moving, low operating, low upkeep* OSHKOSH 4-Wheel Drive hauling unit with the SOUTHWEST specially developed *high speed* scraper, dirt moving costs of operating this new earth mover are virtually CUT IN TWO.

160 YARDS PER HOUR — 1700 FT. CYCLE

Southwest

4-WHEEL DRIVE EARTH MOVER

of the **NEW LOWER COST** *Earth Moving Methods*

POWER: Diesel powered with traction on all 4 tractor wheels. Large percentage of load on tractor enables the OSHKOSH to go through *sand and other tough going* easily.

SPEED: The OSHKOSH has a speed of up to 35 m. p. h. Using a crawler type tractor as a pusher to assist loading results in the *new unusual speed in scraper operation* which means *lower cost dirt*.

CONTROL: Air powered steering on all 4 wheels reduces strain on operator and permits maneuverability similar to crawler type tractor.

UTILITY: Superior for both long and short hauls.

The special 14 yard high-speed SOUTHWEST Scraper designed especially for the "OSHKOSH" 4-Wheel Drive, 4-Wheel Steer Tractor, has been engineered to meet the new requirements: QUICK LOADING—FAST UNLOADING—RAPID TRAVEL — AIR HYDRAULIC BRAKES on all wheels. Special low gravity Carry Frame makes possible unusual high speed. Results: LOWER COST DIRT. Scraper can also be used as wagon for shovel operation.

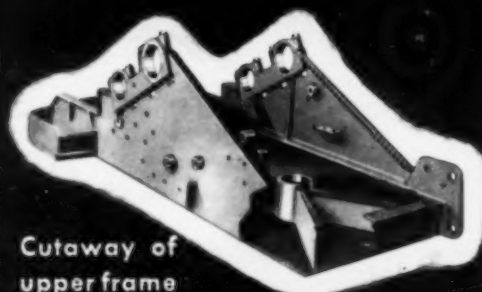
Scraper units available for demonstration at plants of
OSHKOSH MOTOR TRUCK, INC., Oshkosh, Wisconsin
SOUTHWEST WELDING & MFG. CO. Inc., Alhambra, Calif.

● For further information ask your local "Oshkosh" dealer or write
OSHKOSH 4-WHEEL DRIVE SALES AGENCY, exclusive selling
agents, Oshkosh, Wisconsin, U. S. A.



HOW YOU CAN BE
"5 YEARS AHEAD"
OF THE FIELD
IN EXCAVATING EQUIPMENT

● We needn't tell you that excavating jobs usually go to the lowest bidder; nor that it's a real advantage to own the fast, modern equipment that cuts dirt-moving cost to the bone. But we should remind you that P&H began more than five years ago to build excavators entirely of rolled alloy steels—all welded. Others are just beginning. An inspection of these new Pacemakers will quickly convince you that their owners are "five years ahead of the field." Harnischfeger Corporation, 4494 W. National Avenue, Milwaukee, Wisconsin.



Cutaway of upper frame showing sturdy X-frame design.

17 DIFFERENT MODELS
ranging from 3/8 to 5 cu. yds.
capacity with 7 attachment combinations.
Gas, Diesel or electric power.
Write for literature on the size
and type you need.

HARNISCHFEGER
CORPORATION

EXCAVATORS • ELECTRIC CRANES • ARC WELDERS



HOISTS • WELDING ELECTRODES • MOTORS

Construction

Methods and Equipment

Established 1919 McGraw-Hill Publishing Company, Inc.

ROBERT K. TOMLIN, Editor

Volume 20

June, 1938

Number 6



FREEZING PLANT installed by TVA engineers to form solid collar of earth surrounding 20-ft.-diameter test shaft at Gilbertsville damsite.

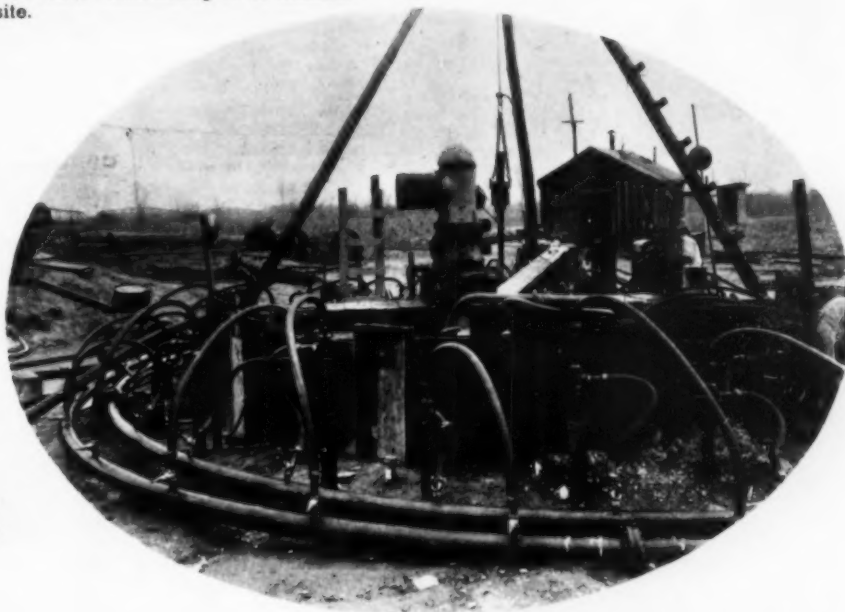
went down to within 14 ft. of bedrock when inflow of ground water became so great as to force silt through the caulked seams between the steel piling. It was then decided to install a refrigerating plant and freeze solid the area surrounding the cell. This is a method used throughout Europe, particularly in Germany, France, and Belgium, to protect deep coal mine shafts from filling with water. It is also common engineering practice when driving a shaft through quicksand. Refrigerating methods have been used at the Grand Coulee dam project in Washington to prevent land slides.

At the Gilbertsville damsite, about 30 pipes are placed vertically in the ground at 30-in. intervals around the outside of the test shaft. They extend down to bedrock. Cold brine is circulated through the system of pipes,

FREEZING

Prevents Seepage at

TVA Test Shaft



THIRTY PIPES, sunk vertically at 30-in. intervals around shaft, to bedrock, provide for circulation of brine chilled by ammonia cooling system.

FREEZING THE GROUND surrounding a huge test shaft at the Gilbertsville dam site to prevent seepage into the pit is the method employed by the Tennessee Valley Authority for the purpose of examining the foundation rock. The test

shaft itself measures 20 ft. in diameter and is to be sunk about 95 ft. to bedrock. It is constructed of interlocking steel sheetpiling, much as the cells that make up the cofferdams at Chickamauga and Guntersville dams are formed. It is unusual for this size

test shaft to be driven at such an early stage of investigation on a construction project, but the Authority's engineering staff feels that the size of the dam contemplated at Gilbertsville warrants this added precaution.

Excavation within the steel cell

the brine being continuously recharged by an ammonia cooling system. With the subsoil thus frozen solid for several yards around the shaft, excavation can continue unimpeded.

This Month's

"NEWS BREEZ"

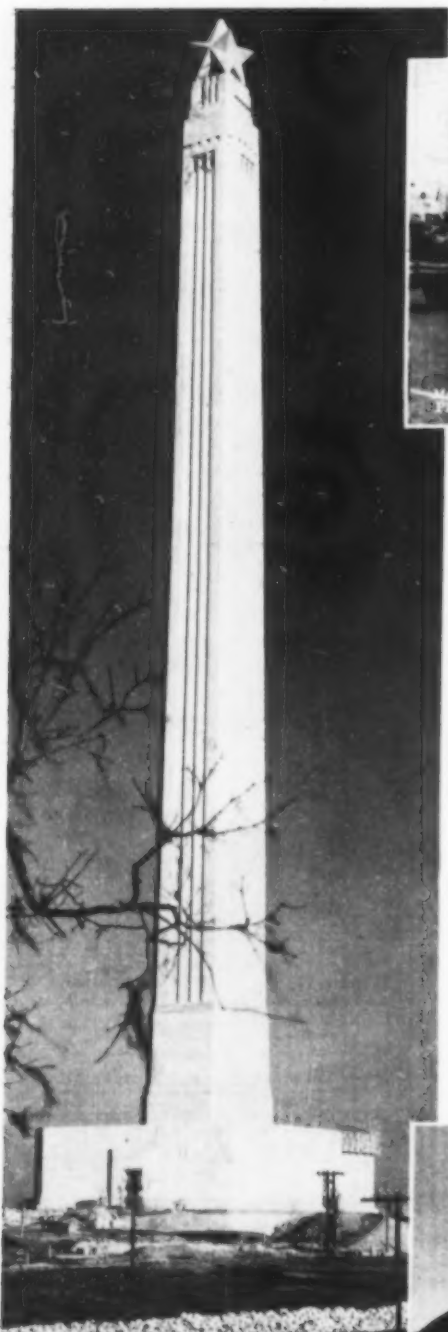


Wide World Photo

HOLED THROUGH! New Jersey heading of second (north) tube of Lincoln tunnel under Hudson River reaches ventilating shaft caisson on New York City side May 2. Pipe extended from 31-ft.-diameter shield allows Harry Stribling, general superintendent for Mason & Hanger Co., Inc., contractor, to make under-river crossing from New Jersey to New York and accept hand-clasp from W. R. Ury, superintendent of crew on New York end of bore. In 5,060-ft. journey from New Jersey shore through river silt shield maintained high average daily advance of 29.6 ft. Tunnel is being built by Port of New York Authority, with Col. C. S. Gleim in charge of construction under O. H. Ammann, director of engineering, and J. C. EVANS, chief engineer. Charles Crandall is resident engineer and Miles Kilmer general manager for Mason & Hanger Co.



PRIZE FLOAT in construction division of New York World's Fair preview motorcade, April 30, was entered by Hicks Nurseries, Inc., of Westbury, L. I., using housing as theme of its display.



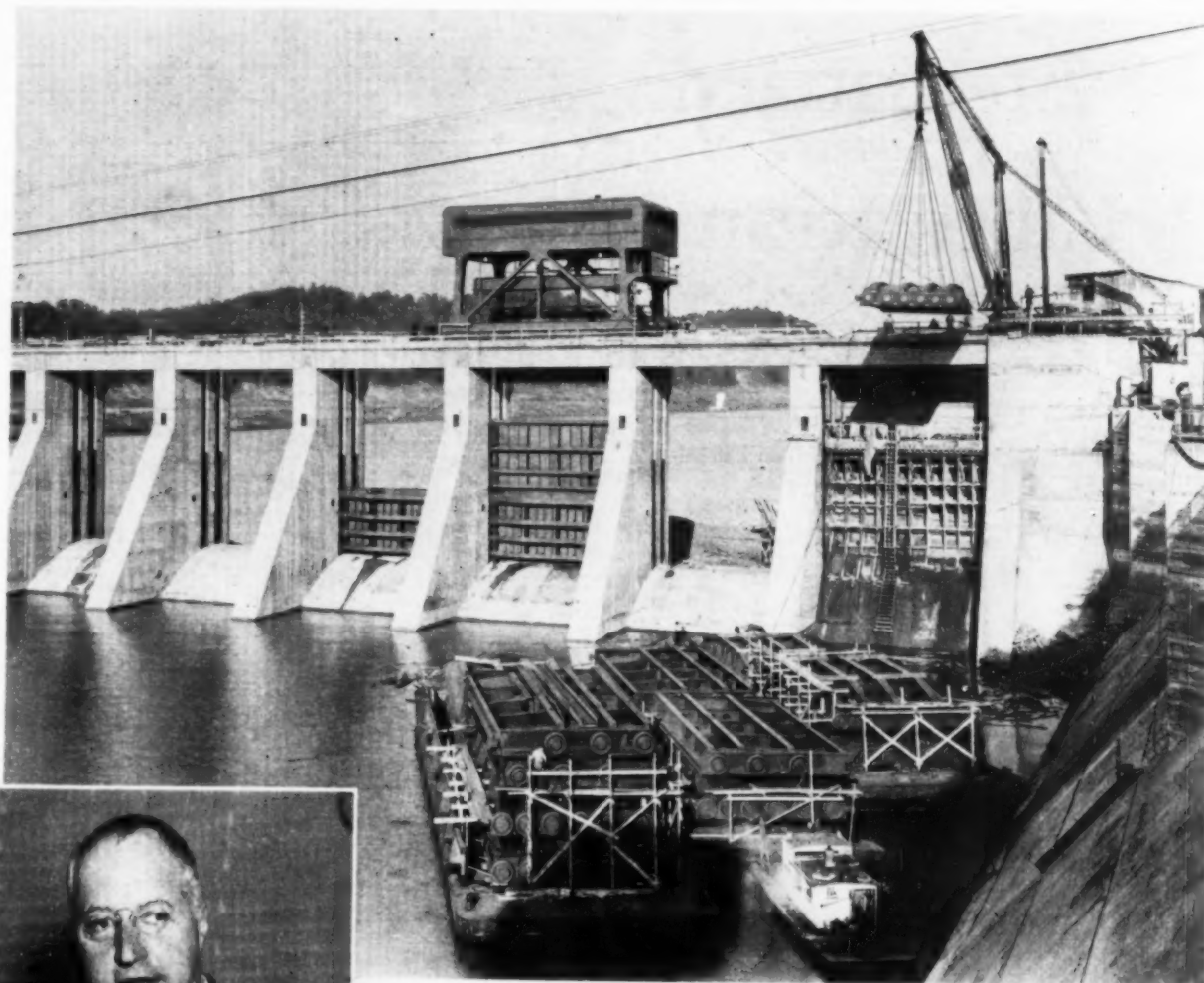
SAN JACINTO MEMORIAL TOWER, limestone-faced concrete shaft 564 ft. high near Houston, Tex., is completed by W. S. Bellows Construction Co., of Houston. Structure on heavily reinforced concrete footing was built with aid of suspended scaffold, as described in **CONSTRUCTION Methods and Equipment** for February.

CRASH goes upper 175-ft. section of central steel tower (right) as 3,400-ft. suspension bridge, built to carry concrete aggregates across Columbia River for Grand Coulee dam, in Washington, is demolished by Consolidated Builders Inc., who succeed M.-W.-A.-K. Co., as contractors for topping out dam to ultimate height of 533 ft. Since base of dam has been completed suspension bridge was superfluous. Hereafter, all concrete mixing will be done on east side of river and cement will cross river through pipe on base of dam.



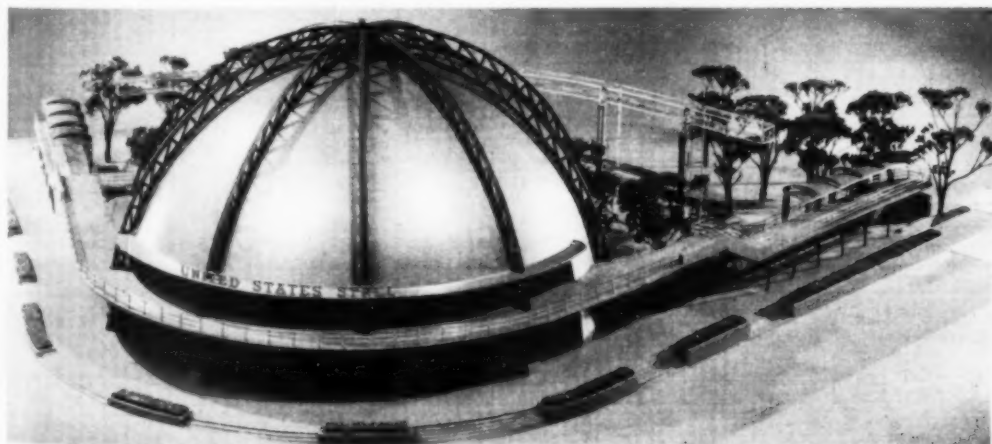
FIRST-PRIZE AWARD OF \$5,000 for design of elevated highway, in competition drawing total of 273 entries and sponsored by American Institute of Steel Construction, is given May 5, in form of check (left), by CLYDE G. CONLEY, (left) president of the Institute, to INGOLF ERDAL (center) and CRAIG P. HAZELET, of the firm of Hazelet & Erdal, consulting engineers, Chicago. Prize design is illustrated elsewhere in this issue.

FIRST STEEL GATES. delivered by barge, are installed with aid of traveling crane on spillway deck of Pickwick Landing dam, built by Tennessee Valley Authority. Spillway contains 22 gate openings, 41 ft. wide. Each gate, fabricated by Dravo Corp., of Pittsburgh, Pa., is composed of a bottom section 20 ft. 5 5/16 in. high, weighing 65 tons and a top section 20 ft. high, weighing 40 tons. Gates have vertical side girders equipped with 30-in. double-flange rolled steel wheels which run on gate tracks in slots.



SPECIAL CONSULTANT to U. S. Housing Authority is Charles E. Lane (left), member of New York building firm of Barr & Lane, Inc. Mr. Lane is conferring with Administrator Nathan Straus. Among other structures, Mr. Lane's company built four major units of famous Rockefeller Center in New York City.

THEME STRUCTURES (right) for New York World's Fair 1939, in form of 700-ft. three-sided steel tower, or Trylon, and 200-ft.-diameter steel globe, or Perisphere, take form on Flushing Meadow Park site, New York City. Steel for both structures is being erected by American Bridge Co. Exterior finish will be white stucco. Steel members for Perisphere are handled by pair of stiff-leg derricks mounted on opposite corners of a tall steel erection tower.

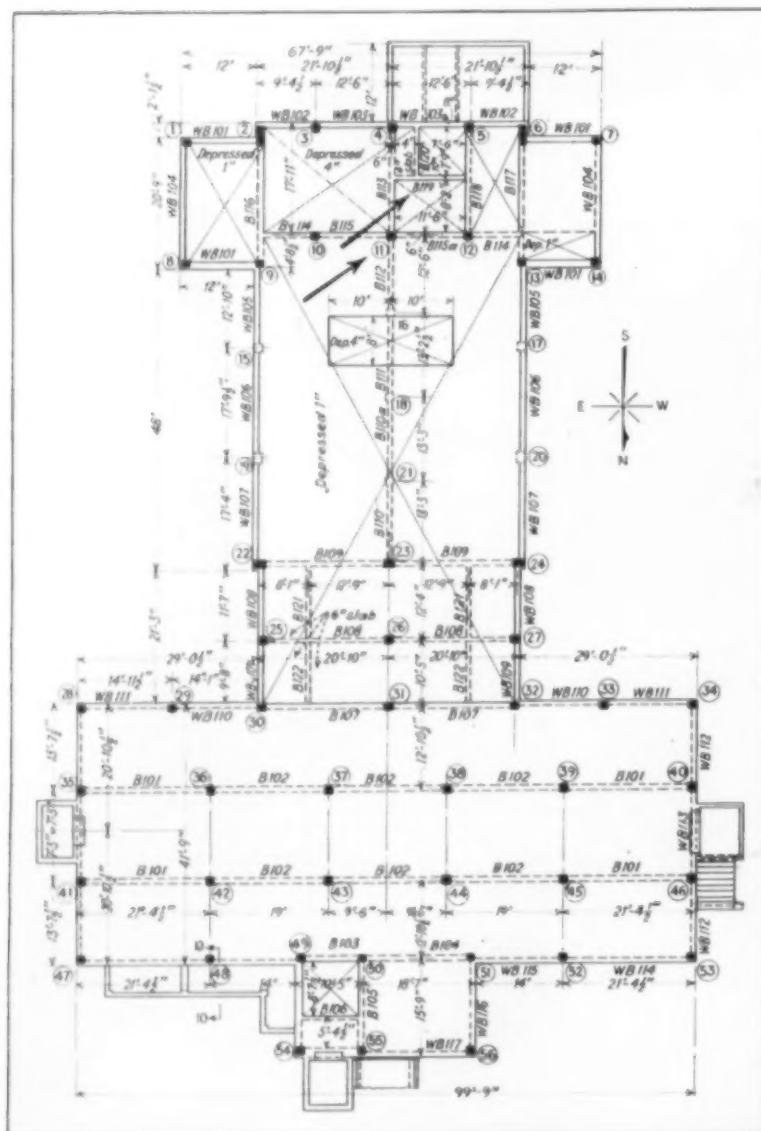


STAINLESS STEEL will form hemispherical dome of U. S. Steel Corporation's unique "inside out" exhibit building at New York World's Fair, 1939. Dome, supported by 10 curved external trusses, has diameter of 132 ft. and height of 66 ft. Designed by Walter Dorwin Teague. Steel framework will conceal lighting fixtures to illuminate the 28,000 sq. ft. of burnished dome surface at night.

Systematized Fabrication *Cuts Cost of* Bench-Made Forms

By J. W. CORNELIUS

General Superintendent of Construction,
Farm Security Administration,
Route 2, Box 87A, Birmingham, Ala.



FLOOR FRAMING PLAN locates columns and beams noted in accompanying form fabrication schedules. Column 11 and Beam B-119 (indicated by arrows) receive special attention in text.

Note: North and South panels are fillers, East and West are covers

SUPT. FL.	COLUMN NO.	COLUMN SIZE	PANELS		NORTH PANEL				SOUTH PANEL				EAST PANEL				WEST PANEL				CLEANOUT	STORY POLE	REMARK			
			N&S	E&W	SIDE	WP	DP	SL	SR	SIDE	WP	DP	SL	SR	SIDE	WP	DP	SL	SR	SIDE				WP	DP	SL
F	1	15x15	15	17 1/2	R	12 1/2	28 1/2	11 1/2	X	X	X	X	X	X	X	X	X	X	L	9 1/2	28 1/2	X	11 1/2	X	16'-10"	
I	2	15x39	15	41 1/2	L	12 1/2	33 1/2	X	11 1/2	X	X	X	X	X	9 1/2	28 1/2	11 1/2	X	L	9 1/2	28 1/2	X	15 1/2	X	16'-10"	
R	3	15x15	15	17 1/2	X	X	X	16 1/2	11 1/2	X	X	X	X	X	R	9 1/2	28 1/2	11 1/2	X	L	9 1/2	28 1/2	X	15 1/2	X	16'-10"
S	4	15x18	15	20 1/2	C.L.	13 1/2	25 1/2	8 1/2	11 1/2	X	X	X	X	R	9 1/2	28 1/2	11 1/2	X	L	9 1/2	28 1/2	X	4 1/2	X	19'-1"	
T	5	15x15	15	17 1/2	C.L.	13 1/2	23 1/2	11 1/2	X	X	X	X	X	R	9 1/2	28 1/2	11 1/2	X	L	9 1/2	28 1/2	X	11 1/2	X	11'-11"	
	6	15x39	15	41 1/2	R	12 1/2	33 1/2	10 1/2	X	X	X	X	X	R	9 1/2	28 1/2	11 1/2	X	L	9 1/2	28 1/2	X	10 1/2	X	11'-11"	
	7	15x15	15	17 1/2	L	12 1/2	28 1/2	X	10 1/2	X	X	X	X	R	9 1/2	28 1/2	11 1/2	X	L	9 1/2	28 1/2	X	X	X	11'-11"	
	8	15x15	15	17 1/2	X	X	X	X	X	L	12 1/2	28 1/2	X	11 1/2	X	X	X	X	R	9 1/2	28 1/2	11 1/2	X	X	X	16'-10"
	9	18x21	18	23 1/2	R	12 1/2	28 1/2	15 1/2	X	R	12 1/2	33 1/2	11 1/2	X	L	9 1/2	28 1/2	X	11 1/2	X	X	X	15 1/2	15 1/2	X	16'-4"
	10	18x12	18	14 1/2	X	X	X	15 1/2	15 1/2	X	X	X	16 1/2	11 1/2	R	11 1/2	17 1/2	15 1/2	X	L	11 1/2	17 1/2	X	15 1/2	X	16'-6"
	11	20x15	20	17 1/2	C.L.	13 1/2	25 1/2	15 1/2	15 1/2	C.L.	13 1/2	25 1/2	16 1/2	X	R	11 1/2	17 1/2	15 1/2	X	L	11 1/2	17 1/2	X	15 1/2	X	19'-1"
	12	20x12	20	14 1/2	X	X	X	15 1/2	15 1/2	C.L.	13 1/2	23 1/2	X	11 1/2	R	11 1/2	17 1/2	15 1/2	X	L	11 1/2	17 1/2	X	15 1/2	X	11'-10 1/2
	13	15x18	15	20 1/2	L	12 1/2	28 1/2	X	15 1/2	L	12 1/2	33 1/2	X	10 1/2	X	X	15 1/2	15 1/2	R	9 1/2	28 1/2	11 1/2	X	X	X	11'-10 1/2
	14	15x15	15	17 1/2	X	X	X	X	X	R	12 1/2	28 1/2	10 1/2	X	L	9 1/2	28 1/2	X	11 1/2	X	X	X	X	X	X	11'-10 1/2
	15	16x16	16	18 1/2	R	12 1/2	28 1/2	15 1/2	X	L	12 1/2	28 1/2	X	15 1/2	X	X	X	X	X	X	X	15 1/2	15 1/2	X	15'-10"	
	16	12x12	12	14 1/2	C.L.	13 1/2	25 1/2	19 1/2	19 1/2	C.L.	13 1/2	25 1/2	15 1/2	15 1/2	X	X	X	15 1/2	15 1/2	X	X	X	15 1/2	15 1/2	X	15'-3"
	17	16x16	16	18 1/2	L	12 1/2	28 1/2	X	15 1/2	R	12 1/2	28 1/2	15 1/2	X	X	X	X	15 1/2	15 1/2	X	X	X	X	X	X	13'-6"
	18	12x12	12	14 1/2	C.L.	13 1/2	25 1/2	15 1/2	15 1/2	C.L.	12 1/2	25 1/2	15 1/2	15 1/2	X	X	X	15 1/2	15 1/2	X	X	X	15 1/2	15 1/2	X	14'-10"
	19	16x16	16	18 1/2	R	12 1/2	28 1/2	15 1/2	X	L	12 1/2	28 1/2	X	15 1/2	X	X	X	X	X	X	X	15 1/2	15 1/2	X	15'-6"	
	20	16x16	16	18 1/2	L	12 1/2	28 1/2	X	15 1/2	R	12 1/2	28 1/2	15 1/2	X	X	X	X	15 1/2	15 1/2	X	X	X	X	X	X	16'-2"
	21	12x12	12	14 1/2	C.L.	12 1/2	25 1/2	15 1/2	15 1/2	C.L.	12 1/2	25 1/2	15 1/2	15 1/2	X	X	X	15 1/2	15 1/2	X	X	X	15 1/2	15 1/2	X	12'-9"
	22	23 1/2x15	23 1/2	17 1/2	R	11 1/2	9 1/2	28 1/2	7 1/2	X	L	12 1/2	28 1/2	X	15 1/2	X	X	X	R	13 1/2	19 1/2	15 1/2	X	X	X	15'-0"
	23	17x17	17	19 1/2	X	X	X	7 1/2	7 1/2	C.L.	13 1/2	25 1/2	15 1/2	15 1/2	L	13 1/2	19 1/2	X	15 1/2	R	13 1/2	19 1/2	15 1/2	X	X	14'-8"

JOB: B1'D'6 No. 4

Sheet No. 1

JOB B'L'D'G. No. 4

Sheet No. 1

COLUMN FORM SCHEDULE gives dimensions for bench fabrication without recourse to sketches.

TO REDUCE the time and motion lost in building forms for structural or fireproofing concrete by the usual methods, the writer several years ago devised a system providing for fabrication of all forms at work benches with the aid of simple dimension schedules which eliminate need of sketches. Uniformity in the dimensions of the finished panels assures accurate fit and easy erection on the job. Application of this fabricating system on a number of building contracts has reduced form manufacturing costs by about 50 per cent, has eliminated cutting and fitting by the erectors, and has simplified, expedited and cheapened all form-handling operations. The fabricating schedules give, in simple and intelligible form, all the information necessary for the construction of the panels. In addition, specially designed benches speed up production by facilitating the actual fabricating operations.

Only ordinary beam and column forms will be discussed in these notes, although fabrication sheets have been devised for all kinds of formwork. On the project selected for discussion, special and detailed formwork was entirely absent. Sheets for special work are available and can be supplied by the author to those interested.

Basis of System—Designed to save time by eliminating preliminary study of sketches at the work benches, the system is based upon simple schedules of form panel dimensions, one schedule for columns and another for beams, providing all fabricating information in readily usable form. The operations of laying out and making up the panels are aided by the special

benches, which are designed to facilitate dimensioning and to supply bar-tens and nails within easy reach, thus reducing the number of motions required in clamping and nailing. The schedules are made up in advance by the man in charge of formwork, who figures the dimensions directly from the structural drawings.

Forms made from such schedules

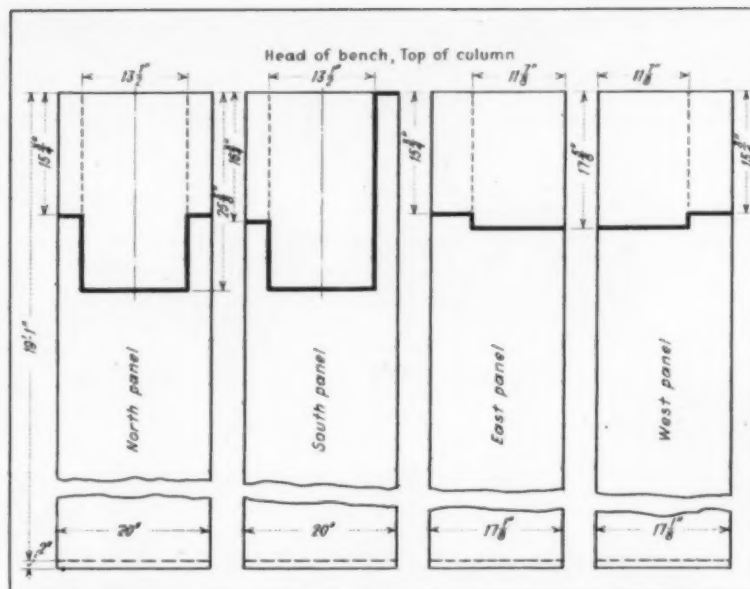


SYSTEM of bench fabrication for concrete forms is devised by J. W. CORNELIUS, author of accompanying notes.

are identical in dimensions, no matter who makes the panels or from what bench they come. Each panel is marked for erection, in the same way that structural steel is marked. This marking, by clearly indicating the location of each panel, enables an unskilled laborer to deliver the form to the spot where it will be erected, saving the time of the erection crew in looking for the proper panels. The time of the erectors further is conserved by the accurate dimensioning, which assures a perfect fit and eliminates cutting and fitting on the job.

To utilize efficiently and unerringly the dimensional information given on a schedule, it is fundamentally necessary that the work on all panels should be properly oriented. A standard orientation for beam and column forms is adopted and thoroughly drilled into the consciousness of the carpenters on each job. The methods of reading and applying the information given in the form schedules can be illustrated by a discussion of column and beam sheets for a portion of building No. 4 (dining hall and attendants' quarters), a reinforced-concrete structure at the United States Veterans Administration Facility, Roanoke, Va., for which Algeron Blair, of Montgomery, Ala., held the general contract. In these schedules, the x's written in by the man who prepared the sheets indicate that no changes in dimensions occur under the headings where the x's appear but that the panels are built flush against the head of the bench with no cutouts whatever.

Column Schedule—At the start of the project, a rule was established for column forms by which all north and south panels were figured as filler



FORM PANELS for Column 11 are laid out and fabricated from schedule. Carpenter adds 2-in. tolerance to allow for varying elevations in structural floor.

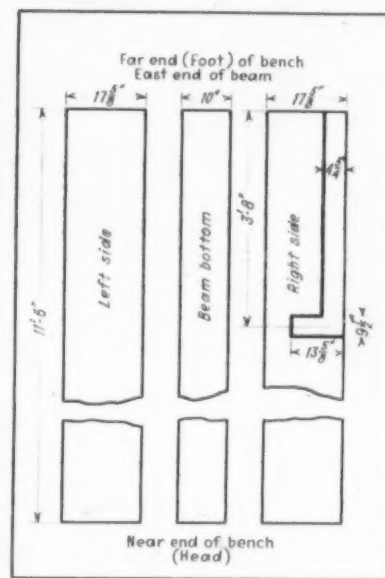
panels and all east and west panels as cover panels. Column panels are fabricated with the finished side face up toward the workman and with the battens underneath. For left and right orientation, the carpenter faces the finish or contact face of the panel. In the case of columns, incidentally, he faces the head or top of the work bench.

In the accompanying schedule of column form dimensions, the first column of the sheet indicates the supporting floor, duly noted as the FIRST. The second column of the schedule carries the numbers of the building columns as given on the structural drawing. In the third column, headed COLUMN SIZE, the structural dimensions of the concrete column are given, the first dimension

being the north and south face and the second dimension the east and west face. The following two columns give the dimensions of the form panels. In the case of the north and south panels, which are the filler panels, this dimension corresponds with that of the concrete columns. For the east and west panels, which are the cover panels, the dimension is equal to that of the concrete column plus twice the thickness of the form stock.

Cutouts—In the four following divisions of the schedule, each of which consists of five columns (with similar headings at the tops of the five columns in the four divisions), the schedule gives the dimensions of pockets cut out of the four panels at the top of the structural column to make way for the beams and slabs

which frame into the column. The location of the pocket is given in the column headed SIDE. If the cutout is entirely on the left side or the right side of the column, its location is designated by the letters L or R. If the center line of the cutout coincides with the center line of the column, the designation C.L. is written into this column. For pockets which do not reach either side of the panel and which do not fall in the center of the form, the location is given in inches from either edge to the adjacent side of the cutout. In the case of column 22, for instance, the distance from the right edge of the panel to the right side of the pocket is 11 3/4 in., as indicated by the abbreviation R+11 3/4. In the second column, WP, and in the third column, DP, each of the four divisions gives the width of



BEAM FORMS for B-119 are bench-fabricated in accordance with dimensions on accompanying schedule (below).

Note: Beam side battens are 1 1/2" x 4" up to 20" - 2 1/2" x 4" flat 20" to 30" - 2 1/2" x 4" on edge above 30", all 24" O.C.

MARK OF BEAM	SIZE	SLAB OR ON LEFT	SLAB OR ON RIGHT	FROM	CL OR BEAM OR FACE OF WALL				TO	BEAM BOTTOM BATTENS	BEAM SECTION			DANGER WIRE LENGTH	BEAM SIDES				POCKET FOR BEAM SIDES	POCKET FOR END OF BEAM	TAPE	TO CL OF POCKET		SLAB LEFT OF POCKET	SLAB RIGHT OF POCKET	FROM CL OF BEAM TAPE	TO CL OF POCKET		SLAB LEFT OF POCKET	SLAB RIGHT OF POCKET	FROM CL OF BEAM TAPE	TO CL OF POCKET		SLAB LEFT OF POCKET	SLAB RIGHT OF POCKET	CONTACT AREA						
					OVERALL	N.	LENGTH BOTTOM	F.			W.	D.	LEFT		N.	F.	RIGHT	N.				F.	W.				D.	W.				D.	W.				D.	W.	D.	W.	D.	W.
WB-101	8	27	11	X	E	C-2	12'-0"	X	10'-9"	15	C-1				15 1/8	X	X	28 3/4	X	X																						
WB-102	8	27	16	X	E	C-3	9'-4 1/2	7 1/2	7'-6"	15	C-2				11 1/8	X	X	28 3/4	X	X																						
WB-103	8	27	16	X	E	C-4	12'-6"	7 1/2	11'-3"	7 1/2	C-3				11 1/8	X	X	28 3/4	X	X																						
WB-103a	8	27	X	X	E	C-5	12'-6"	7 1/2	11'-3"	7 1/2	C-4				28 3/4	X	X	28 3/4	X	X	Left	X	Far	3'-6 1/2	9 1/2	13 1/2	X	4 1/4														
WB-102	8	27	11	X	E	C-6	9'-4 1/2	15	7'-6"	7 1/2	C-5				16 1/2	X	X	28 3/4	X	X																						
WB-101	8	27	10	X	E	C-7	12'-0"	15	10'-9"	X	C-6				17 1/8	X	X	28 3/4	X	X																						
WB-101	8	27	X	11	E	C-9	12'-0"	X	10'-9"	15	C-8				28 3/4	X	X	16 1/2	X	X																						
B-114	10	16	15	16	E	C-10	9'-4 1/2	9	7'-1 1/2	18	B-116				17 1/8	X	X	0 1/2	X	X																						
B-115	10	16	15	16	E	C-11	12'-6"	10	10'-11"	9	C-10				17 1/8	X	X	0 1/2	X	X																						
B-115a	10	16	15	X	E	C-12	12'-6"	10	10'-10"	10	C-11				17 1/8	X	X	17 1/8	X	X																						
B-114	10	16	15	11	E	B-117	9'-4 1/2	13 1/2	7'-5"	10	C-12				17 1/8	X	X	5 1/2	X	X																						
WB-101	8	27	X	10	E	C-14	12'-0"	15	10'-9"	X	C-13				28 3/4	X	X	17 1/8	X	X																						
B-119	10	16	X	X	E	B-118	11'-6"	X	11'-6"	X	B-113				17 1/8	X	X	17 1/8	X	X	Right	X	Far	3'-8"	9 1/2	13 1/2	4 1/4	X														
B-109	12	18	7	15	E	C-23	21'-10 1/2	8 1/2	19'-2 1/2	23 1/2	C-22				11 1/8	X	X	3 1/8	X	X	Left	7 3/4	Near	12'-0 1/2	9 1/2	15 1/2	7 3/4	7 3/4														
B-109	12	18	7	15	E	C-24	21'-10 1/2	23 1/2	19'-2 1/2	8 1/2	C-23				11 1/8	X	X	3 1/8	X	X	Left	7 3/4	Far	12'-0 1/2	9 1/2	15 1/2	7 3/4	7 3/4														
B-108	12	22	7	7	E	C-26	20'-10"	7	19'-0"	15	C-25				15 1/2	X	X	15 1/2	X	X	L & R	7 3/4	Near	12'-2"	9 1/2	15 1/2	7 3/4	7 3/4														
B-108	12	22	7	7	E	C-27	20'-10"	15	19'-0"	7	C-26				15 1/2	X	X	15 1/2	X	X	L & R	7 3/4	Far	12'-2"	9 1/2	15 1/2	7 3/4	7 3/4														
WB-111	8	27	10	X	E	C-29	14'-11 1/2	7 1/2	13'-1"	15	C-28				17 1/8	X	X	28 3/4	X	X																						
WB-110	8	27	10	X	E	C-30	14'-1"	X	13'-5 1/2	7 1/2	C-29				17 1/8	X	X	28 3/4	X	X																						
B-107	12	20	10	7	E	C-31	20'-10"	10	18'-9"	15	C-30				10 1/2	X	X	13 1/2	X	X	Right	7 3/4	Near	11'-11"	9 1/2	15 1/2	7 3/4	7 3/4														
B-107	12	20	10	7	E	C-32	20'-10"	15	18'-9"	10	C-31				10 1/2	X	X	13 1/2	X	X	Right	7 3/4	Far	11'-11"	9 1/2	15 1/2	7 3/4	7 3/4														
WB-110	8	27	10	X	E	C-33	14'-1"	7 1/2	13'-5 1/2	X	C-32				17 1/8	X	X	28 3/4	X	X																						
WB-111	8	27	10	X	E	C-34	14'-11 1/2	15	13'-1"	7 1/2	C-33				17 1/8	X	X	28 3/4	X	X																						
B-101	12	22	10	10	E	C-36	21'-4 1/2	8 1/2	19'-5"	15	C-35				12 1/2	X	X	12 1/2	X	X																						
B-102	12	22	10	10	E	C-37	19'-0"	8 1/2	17'-7"	8 1/2	C-36				12 1/2	X	X	12 1/2	X	X																						
B-102	12	22	10	10	E	C-38	19'-0"	8 1/2	17'-7"	8 1/2	C-37				12 1/2	X	X	12 1/2	X	X																						
B-102	12	22	10	10	E	C-39	19'-0"	8 1/2	17'-7"	8 1/2	C-38				12 1/2	X	X	12 1/2	X	X																						
B-101	12	22	10	10	E	C-40	21'-4 1/2	15	19'-5"	8 1/2	C-39				12 1/2	X	X	12 1/2	X	X																						
B-101	12	22	10	10	E	C-42	21'-4 1/2	8 1/2	19'-5"	15	C-41				12 1/2	X	X	12 1/2	X	X																						
B-102	12	22	10	10	E	C-43	19'-0"	8 1/2	17'-7"	8 1/2	C-42				12 1/2	X	X	12 1/2	X	X																						
JOB BLDG No. 4																																	Schedule of beam bottoms and sides - Pockets in beam sides - Sheet No. 1									

JOB BLDG No. 4

Schedule of beam bottoms and sides - Pockets in beam sides - Sheet No. 1

BEAM FORM SCHEDULE provides column space for use in figuring panel dimensions, but carpenters utilize only figures between heavy lines.

pocket and the depth of pocket for its particular panel. The width of the pocket in this case is equal to the width of the concrete beam plus twice the thickness of the beam-side stock, and the depth of the pocket is equal to the depth of the concrete beam plus the thickness of the beam-bottom stock.

In the final two columns of each



SPECIALLY DESIGNED WORK BENCHES for beam and column forms are grouped around saw tables.

division, headed SL and SR, the schedule gives the depths of the structural slabs framing into the column at the left and the right, plus the thickness of the deck slab stock. The total height of the panel, as given by the story pole in the last column of figures on the schedule, must be shortened by these dimensions on the two sides of the pocket at the top to allow for the slab framing, keeping in mind that dimensions in vertical plane always are taken from the block across the head of the bench which corresponds to the top of the structural slab.

In the column marked CLEANOUT the accompanying schedule indicates that none of the column forms is to be provided with this facility at the time of fabrication. On the project under discussion, this work was done in the field with power saws to avoid misplacing of cleanout pieces in handling. The cleanout consists of removable pieces at the bottoms of all cover panels. These pieces can be removed to permit inspection of reinforcing steel and flushing of the column forms before any concrete is placed. To provide the removable sections, the cover stock is cut on a 45-deg. bevel at the location of the first batten in order that the column clamp may hold both pieces of the cover panel.

In the last column, the story pole dimension is given. This height is measured from the top of the concrete

slab to the upper surface of the slab on the floor above. In actually laying out the panel, for length, the carpenter adds 2 in. at the bottom of the panels to the true story pole given on the schedule to allow for variations in striking off the surface of the rough concrete slab. On the bottom of the panel, however, the carpenter marks the true story height.

Application of Schedule—As an example of the manner in which the column schedule is utilized, we may take column 11, which has actual di-

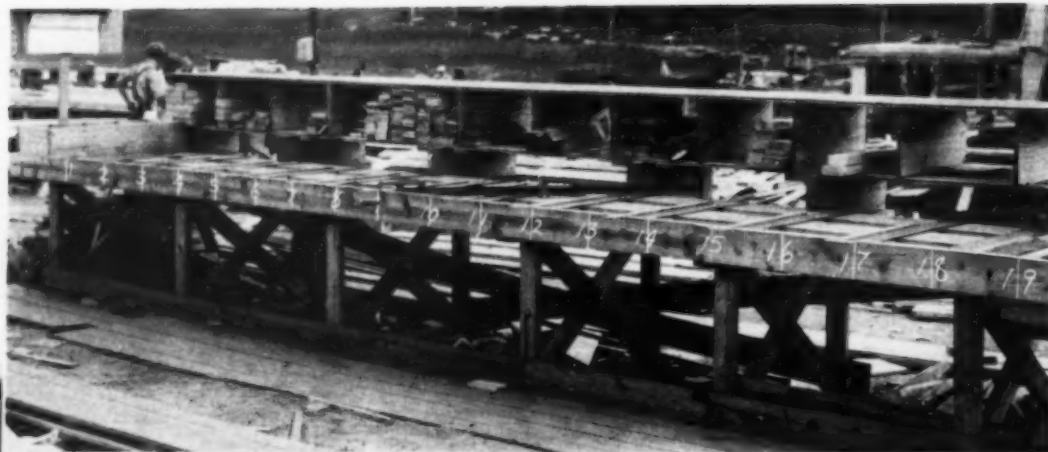
mensions of 20x15 in., calling for filler panels 20 in. wide (N and S) and cover panels 17 $\frac{1}{8}$ in. wide (E and W). For the north panel, a beam pocket (the center of which coincides with the center line of the panel) must be cut out to a width of 13 $\frac{1}{2}$ in. and to a depth, measured from the head of the bench, of 25 $\frac{3}{8}$ in. To take care of the structural slab at the left and right of the column, the panel must be cut off at the top to a depth of 15 $\frac{3}{4}$ in. on each side of the pocket.



BENCH CLAMPS pull sheathing into line before nailing to battens. Iron straps on bench clinch nails under battens.



SAW TABLE speeds cutting of battens in duplicate sizes for form panels.



BENCH FOR BEAM FORMS is marked in feet from head of bench to speed measuring of form lengths. Pockets at back of bench hold battens of various dimensions.

In the south panel of this column, a similar pocket must be cut out, but provision for a structural slab needs to be made only on the left side, where the depth of the slab plus the thickness of the deck stock is 16 $\frac{3}{4}$ in.

In the east panel, the cutout for the beam pocket is made on the right side of the panel for width of 11 $\frac{7}{8}$ in. (because in cover panels the width of pocket cutouts falling on either edge must be the width of the concrete beam plus the thickness of the column and beam side stock) and a depth of 17 $\frac{7}{8}$ in. A cut of 15 $\frac{3}{4}$ in. from the top of the column provides for a structural slab framing into the column from the left. In the west panel, matching cutouts are made, the only change in direction being the substitution of L for R and vice versa.

When fabricated, the four column panels are as shown by the accompanying sketch.

Beam Schedule—Before taking up the beam schedule, it may be well to repeat that the sheets are completely filled in by the foreman responsible for formwork before they are handed

to the bench carpenters. Certain columns on the sheet are put there to aid the foreman in making his computations; but the carpenters need concern themselves only with the final dimensions marked in the proper columns (inclosed between *heavy lines*).

In the first column of the beam fabrication sheet, one finds the beam designation taken from the structural drawing. Under the general heading **SIZE**, in the following two columns, the sheet gives the actual width and depth of the concrete beam, the depth being measured from the soffit to the top of the structural slab.

To understand the information contained in the next two columns, it is necessary to refer to the column headed **FACING**. It should be remembered that the carpenter always works with the finished side of the panel up and faces south on north-and-south beams and east on east-and-west beams. In the case of east-and-west beams, the foot or far end of the bench is the east end of the beam; in other words, the workman faces east. For north-and-south beams, the foot or far end of the bench is the south end, and the carpenter correspondingly faces south. The col-



AT HEAD of bench is vertical board to hold fabricating schedule. Movable horizontal stick guides carpenter's eyes in reading dimensions.

umns **SLAB ON LEFT** and **SLAB ON RIGHT** give the actual structural thickness of the concrete slabs framing into the beam on the two sides.

In the next six columns, starting with **FROM** and ending with **TO**, inclusive, the fabricating schedule gives: The location of the beam; the overall length (between column cen-

ters, beam center lines, or wall faces, depending upon structural conditions); and the actual length of the beam bottom to be fabricated. Under the column **FROM**, which designates the head (also known as the near end) of the bench, is placed the number of the supporting column or member at the north (or west) end of the beam. The next column gives the overall length of the beam, which may be measured, depending upon the structural connections of the beam

in question, either between column centers or from column center to center line of transverse beam or from any such center to the face of a wall. Under column headed **N** is given the dimension to be subtracted from the near end of the bench (in the case of a column, this dimension is one-half the column thickness), and under the column headed **F** is a similar dimension to be subtracted from the far end. By adding together these two dimensions and subtracting them from the overall length, the resulting **LENGTH OF BOTTOM**, is obtained. This last dimension, **LENGTH OF BOTTOM**, is the only one which the carpenter reads and uses.

Information contained in the next five columns is intended for use on fireproofing jobs only. The fabricating sheet is designed to take care of this kind of work as well as construction of reinforced-concrete buildings.

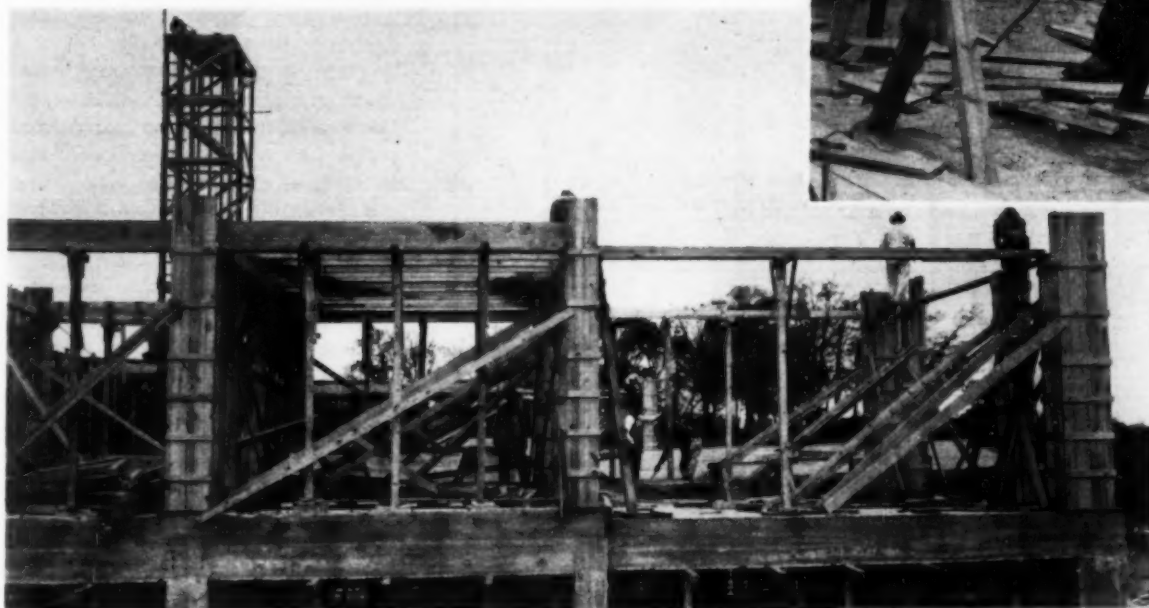
Beam Sides — In the six columns headed by the term **BEAM SIDES**, left and right are found as already indicated. The width of the beam-side panel is figured by referring to the depth dimension given in the third column of the sheet, subtracting from it the dimension shown in column slab on left, and adding the difference in thickness in the stock of beam bottom and deck. It can be seen that,



COMPLETE ERECTION MARKING on every form panel gives location in structure and facilitates distribution by unskilled labor.



POWER SAW makes cutouts and cutoffs after panel has been dimensioned on work bench.



FORM PANELS fabricated to uniform, accurate dimensions, no matter which carpenter makes them, aid rapid, trouble-free erection in structure.

when $1\frac{3}{8}$ -in. stock is used for the beam bottom and $\frac{3}{4}$ -in. stock for the deck slab, the difference of $\frac{7}{8}$ in. must be added to the width of the beam side in order to have the side panel cover the beam bottom. The columns headed **N** and **F** stand for the near and far ends of the beam side. These columns give any dimensions to be subtracted from or added to the beam side at either end.

Beam-Side Pockets — In the next group of eight columns are given

the location and dimensions of cutouts in the beam-side form. Under the first heading, **POCKETS IN BEAM SIDES**, the schedule indicates whether the left beam side or the right beam side, or both, is affected. In the following column, **FIGURED FOR SLAB**, is given the dimension (equal to the depth of structural slab plus the thickness of the deck stock) already utilized in computing the width of the beam side. The next column indicates to be made to locate the center line of the cutout, and the following column, headed **TAPE**, gives the distance to be measured.

In the double column under the general heading, **TO C.L. OF POCKET**, the width and depth of the pocket are expressed. To take care of any variation in the depth of slab on the two sides of the pocket, the next two columns give these depths. Where either of the slab depths is greater than that given under the heading, **FIGURED FOR SLAB**, the beam side form is made up to the shallow slab width, and the difference of slab depth on either side of the pocket is removed with power saws.

Two duplicate groups of five columns each (following the last-mentioned section of eight columns) give the location and dimensions of any additional beam-side pockets. Where required for computing form costs, the form area actually in contact with the concrete is placed in the final column of the sheet, under the heading, **CONTACT AREA**.

Application of Beam Schedule — To illustrate the method of utilizing this sheet, let us take beam B-119 as an example. The width of the structural beam is 10 in. and the depth is 16 in. Because this beam has structural openings in the floor of the building on both sides, the two columns, **SLAB ON LEFT** and **SLAB ON RIGHT**, are left blank. As the beam is an east and west member, the carpenter faces east and places this end at the foot, or far end, of the bench. At this end the beam frames into beam B-113, as indicated under **TO**: at the near (or west) end it frames into beam B-118, as marked under **FROM**.

On the structural drawing, the clear span of this beam, 11 ft. 6 in., is given. Accordingly, the man in charge of the formwork takes off this dimension and uses it both for the overall length and for the length of the beam-bottom form, without subtracting anything from the near and far ends.

As for the beam-side forms, the depth of both the left panel and the right panel is obtained by adding the structural depth of the beam (16 in.) to the thickness of the beam bottom stock ($1\frac{3}{8}$ in.), giving a total depth of beam side of $17\frac{3}{8}$ in. This procedure is correct in the case of the beam in question because no slab to right or left needs to be considered in figuring this dimension. However, a pocket does occur in the right beam side where beam B-120 frames into beam B-119. Measuring

from the far end of the bench, the distance to the center line of this pocket is 3 ft. 8 in., and the cutout itself is $9\frac{1}{2}$ in. wide by $13\frac{3}{8}$ in. deep, as shown under the respective headings, **W** and **D**. Furthermore, the structural drawing shows that a slab frames into the right side of beam B-119 to the east of beam B-120. This slab is 4 in. deep. To provide for it, the width of the beam-side form to the left of the pocket must be reduced by $4\frac{3}{4}$ in., equal to the depth of the structural slab plus the thickness of the deck slab stock.

Bottom and side forms for Beam B-119 are shown in an accompanying drawing.

Work Benches — Carpenters' work benches used in building the forms are designed specifically for column panels or for beam panels, with iron straps (properly located as to batten spacing), to clinch wire nails driven through the lumber, thus eliminating the necessity of turning the panels to clinch the nails by the old hammer method. At each end of the bench is attached a nail box divided into bins marked for nails of the proper size. The back of the bench is provided with shelves divided into box-shaped compartments for battens of different lengths. A plentiful supply of battens of proper lengths is maintained in these compartments at all times by the mill helpers, who make replacements as the stock is used up by the carpenters.

Along the front of the bench,

notches are cut and properly marked to indicate the distance in feet from the head of the bench, eliminating the use of a steel tape in measuring the length of form panels. For a panel with a total length of 12 ft. 9 in., for example, the carpenter needs to measure only the 9 in. from the 12-ft. mark. At the head of the column benches, a yardstick nailed along the front piece of the bench obviates the need of rule measurement in laying out beam pockets in the column panels.

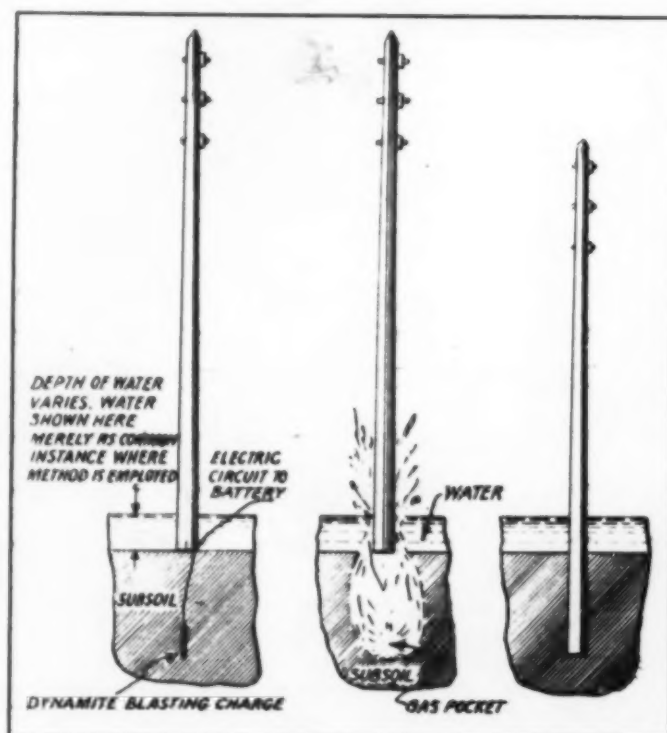
At the head of every bench, a vertical board is erected at about the height of the carpenter's head to hold the fabricating sheet from which he reads dimensions. This board is equipped with a sliding horizontal stick which is moved down as panels are completed. The stick guides the eye definitely to the line of figures for the panel being fabricated and thus greatly facilitates the process of reading the proper dimensions. As the carpenter finishes the panels for a column or beam, he draws a pencil line through the proper row of figures on the schedule to indicate that the forms for this member are completed. Before a form panel leaves the bench, it is marked by the carpenter to indicate its location and position on the job. All benches are provided with 4-ft. bench clamps which eliminate toenailing and pull warped material into line before nailing the sheathing to the battens. These features contribute to the ease and speed of work at the benches.

BLASTING Sets Poles Without Digging Holes

THE METHOD used by a contractor in North Carolina recently in order to set poles for a power line in soft sand whereby resort was had to dynamite illustrates a procedure effective in such work, according to Arthur La Motte, manager of the technical section of E. I. du Pont de Nemours & Co.'s explosives department. In such situations considerable success has followed the practice of blasting the pole hole and setting the pole in one operation.

A hollow drill of about $1\frac{1}{2}$ -in. pipe is driven into the ground to the depth desired for the bottom of the pole. The soil is forced out through the lower end of the drill with a ram. A sand point on the end of the drill will help where the soil is such that it clogs the pipe, making ramming difficult. The pipe can be withdrawn leaving the sand point in the hole.

The charge of dynamite, primed preferably with an electric blasting cap, is pushed down through the pipe to the



THREE STEPS in setting poles in soft soil by blasting.

bottom and the pipe withdrawn. The pole is then raised above the surface directly over the dynamite and held in place by pike poles or rigged four ways, and the dynamite is detonated. The explosion will create a pear-shaped pocket into which the pole will settle as the gases rush upward. The ground and water pressures press the soil back around the pole. Care should be taken to see that the pole is exactly upright before the blast.

The amount of dynamite needed varies with the soil conditions encountered, but the following are suggested by experienced blasters who have done this work. In each case 40 per cent straight dynamite is recommended: a 6- to 7-ft. depth hole in swamp with muck underlying, $2\frac{1}{2}$ cartridges; a 5- to 7-ft. hole in swamp with muck and rock underlying, 3 cartridges; a 7- to $7\frac{1}{2}$ -ft. hole in sand and water, 3 cartridges; a 6- to 7-ft. hole in coral rock, 4 to 5 cartridges.

The sketch illustrates the method.



AT A COST of \$23,000, the Michigan Highway Department has equipped 70 mi. of rural highway on U. S. 16 between Detroit and Lansing with reflector markers which light the roadway by reflection of rays from automobile headlamps for 1 mi. ahead of the vehicle, serving as a guide to the motorist, protection against collisions, relief from glare of approaching lights, improved penetration in fog, reduction in eye strain and diminution of fatigue in night driving. Preliminary tests by experienced drivers on the General Motors proving grounds at Milford, Mich., demonstrated these qualities and emphasized the relief from eye strain and fatigue. A driver's eyes shift from the straight-ahead line to the reflectors, permitting night operation without looking at the headlights of oncoming traffic.

Each marker contains three reflector buttons $1\frac{1}{8}$ in. in diameter (as compared with the $\frac{3}{16}$ -in. to $\frac{3}{4}$ -in. buttons now in general use) cast in a steel standard set in the ground at the edge of the shoulder, 8 ft. from the pavement, or 10 ft. from the pavement where the shoulder is 18 ft. wide. Reflectors are made of lucite, a plastic that is water-clear, flexible and non-shattering. The material remains permanently transparent outdoors, retains its crystal color without change, and gives a stable white light. No silver or metallic surfaces are used behind the lenses, as reflection is obtained by the high degree of accuracy built into the cube corners making up the back of reflector disks. Because of accuracy with which it can be molded, a plastic reflector is said to be ten times as efficient as pressed glass.

Markers are spaced 100 ft. apart along both edges of rural sections of the highway, which traverses a total distance of 85 mi. between Detroit and Lansing. For the 70-mi. rural installation, the State Highway Depart-

REFLECTOR MARKERS

Improve Safety of Night Driving on 70-Mile Highway



SLIP HAMMER ceases driving while rule and level line check height of point at which central bullseye will be located, 3 ft. above edge of pavement.

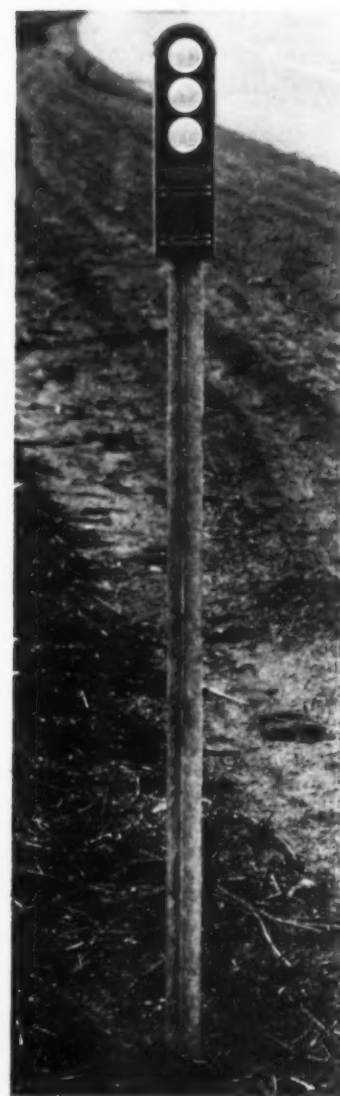
ment used about 6,900 markers, installed at an average cost of \$346.63 per mile or \$3.43 per unit. Of this cost, 86.7 per cent represented material and 13.3 per cent installation expense.

Reflector holders are mounted on $1\frac{1}{4} \times 1\frac{1}{4} \times 9/64$ -in. angle posts, ordinarily 6 ft. long, galvanized after fabrication. A special 40-lb. slip hammer to drive posts and a special wrench to hold them while being driven were developed for the installation job. A typical crew of twelve

men operating four hammers, with one man placing reflectors and another driving a $1\frac{1}{2}$ -ton stake-body truck, could average 5 mi. of two-line installation in 9 hr.

Murray D. Van Wagoner, state highway commissioner, directed the installation of reflectors on heavily traveled highway. Lucite, the plastic used in prisms, was perfected by E. I. duPont de Nemours & Co., Wilmington, Del. The Signal Service Corp., Elizabeth, N. J., supplied complete highway units for installation.

DISTINCTLY DELINEATED by two lines of reflector markers, roadway presents fewer hazards to driver after dark. Any interruption of uniformly spaced reflections warns motorist that he is approaching abutting driveway, strolling pedestrian or vehicle without lights.



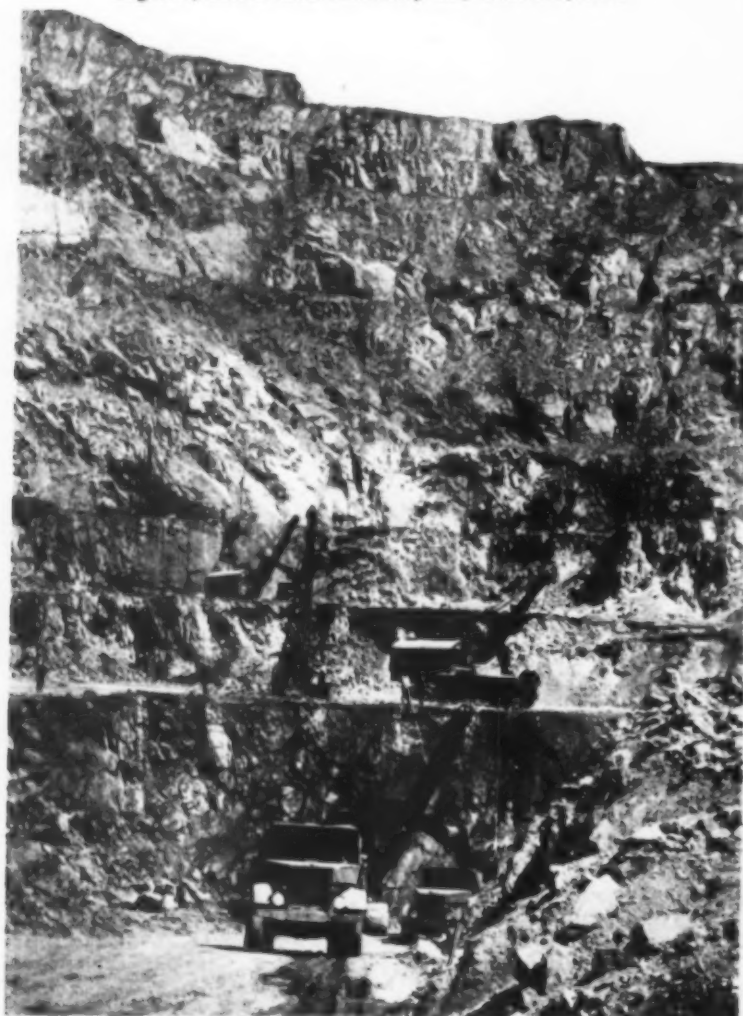
TRIPLE PRISMATIC REFLECTORS of large diameter are mounted in yellow enameled holder keyed to post. On two-way traffic roads markers carry reflector buttons on both faces.

COSTS OF CONSTRUCTION HAULAGE

FIRST OF A GROUP OF ARTICLES BASED ON FIELD STUDIES
OF RUBBER-TIRED AUTOMOTIVE EQUIPMENT

By HORACE K. CHURCH

Engineer, Euclid Road Machinery Co., Cleveland, Ohio



OPEN-PIT COPPER MINE uses four 20-ton trucks to haul ore from 2-yd. shovel. One truck is approaching camera up 10 per cent grade, while second unit is being loaded by shovel in background.



SIDE-DUMP BODIES discharge load of ore into inclined chute in average time of 0.4 min.

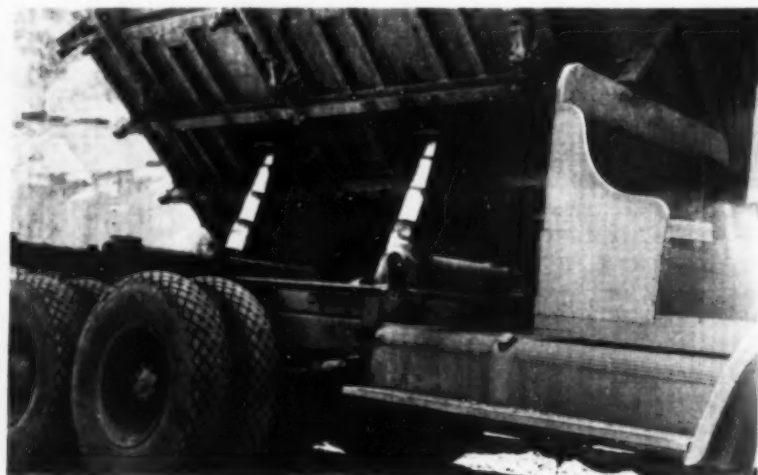
● THIS ARTICLE is the first of a group outlining methods of cost analysis and control for automotive hauling operations on construction projects. Related articles will appear in subsequent issues. Each article is complete in itself; taken as a group, the entire series will furnish a comprehensive basis for analyzing and evaluating cost factors involved in ownership and operation of pneumatic-tired automotive hauling equipment. Portions of the articles refer specifically to earth-moving projects, but most of the information contained in them is applicable to any kind of material-hauling operation.

DETAILED ANALYSES of about 75 separate applications of rubber-tired automotive equipment to construction and industrial haulage in the United States have revealed to the writer a general need for additional information on haulage costs to assist con-

tractors and estimators in figuring hauling expense correctly and in holding it to a minimum after a job has started. An analysis of haulage on any project requires adequate field study to determine the factors of production — hauling cycle and payload. To indicate the form in which data are gathered and utilized, a typical field study of trucks in an open-pit copper mine is reproduced in abridged form with these notes. This field investigation required about two days of stop-watch and production studies, together with assembling of pertinent general information. Field study methods follow those used by the Division of Management of the U. S. Bureau of Public Roads.

General Conditions — An open-pit copper mine installed four 20-ton side-dump trucks to haul copper ore, loaded by a Bucyrus-Erie 50B 2-yd. shovel, to an inclined chute and side-dump the ore into the chute opening. The copper ore weighs about 6,000 lb. per cubic yard in the solid state, prior to drilling and blasting. When loaded into the hauling units it weighs, in loose condition, about 4,500 lb. per cubic yard. Average weight of a truck load is about 18 tons.

During the study the trucks were operating on both short and long hauls. All haul roads were in reasonably good condition—typical hard quarry floors.



FOUR-STAGE TELESCOPIC HOISTS raise side-dump bodies of 20-ton trucks carrying average load of 18 tons.



ON LONG HAUL of 1,400 ft., trucks travel at average speed of 8 m.p.h. in both directions.

Table 1 . . . Hauling Cycles

SHORT HAUL	
Loading 7 to 9 buckets of ore from 2-yd. shovel	3.5 min.
Hauling 300 ft. up average 10 per cent grade at average speed of 2 m.p.h.	1.8 "
Dumping in chute	0.4 "
Returning by backing 300 ft. downgrade at average 4 m.p.h.	1.0 "
Net round trip time	6.7 min.
Average delay at shovel	1.5 "
Gross round trip time	8.2 min.
LONG HAUL	
Loading 7 to 9 buckets of ore from 2-yd. shovel	3.5 min.
Hauling 1,400 ft. down average 2 per cent grade at average speed of 8 m.p.h.	2.0 "
Dumping in chute	0.4 "
Turning at chute	0.6 "
Returning 1,400 ft. upgrade at average 8 m.p.h.	1.9 "
Turning at shovel	0.5 "
Net round trip time	8.9 min.
Average delay at shovel	.8 "
Gross round trip time	9.7 min.

Table 3 . . . Unit Hauling Costs

SHORT HAUL OF 300 FT., ONE WAY	
Gross round trip time	8.2 min.
Trips, or loads hauled, per working hour	7.3 loads
Tonnage hauled per load	18 tons
Tonnage hauled per hour, each truck	131 tons
Unit cost, cents per long ton	3.6 c.
LONG HAUL OF 1,400 FT., ONE WAY	
Gross round trip time	9.7 min.
Trips, or loads hauled, per working hour	6.2 loads
Tonnage hauled per hour, each truck	112 tons
Unit cost, cents per long ton	4.2 c.

Length of the short haul was 300 ft., one way, up an average 10-per cent steady grade. On this haul, the trucks made no turns but shuttled back and forth between the loading shovel and the chute opening, without turning at the ends of the run.

One-way travel on the long haul was 1,400 ft. Loaded trucks traveled for 1,000 ft. after leaving the shovel on a road that was about level. The remaining 400 ft. was down a 5-per cent grade, giving the average downgrade for the 1,400 ft. total distance of about 2 per cent.

Hauling Units—Trucks used in

the open-pit mine are three-axle type, load carried on back. Truck engines are six-cylinder, $4\frac{3}{8} \times 5\frac{3}{4}$ in., 580-cu.in. displacement, 130 hp. at 2,300 engine r.p.m. The transmission has five speeds forward, and the auxiliary transmission has three speeds forward or reverse. Units have four-wheel rear drive and Westinghouse air brakes on all six wheels.

Table 2 . . . Estimated Hourly Expense

FOR OWNERSHIP AND OPERATION OF ONE TRUCK	
Approximate delivered price of one unit	\$14,700
Depreciation period—10,000 hr., 2 years of 5,000 hr. ea.	
FIXED HOURLY CHARGES	
Interest, taxes, and insurance—7 per cent of delivered price per year of 5,000 hr.	\$0.21
Depreciation—straight line method with no assumed salvage value	1.47
	\$1.68
VARIABLE HOURLY CHARGES OR OPERATING EXPENSES	
Mechanical repairs and replacements (including labor) at 50 per cent of delivered price per 10,000 hr.	\$0.74
Tire and tube repairs and replacements—complete set every 7,500 mi. or about every 2,500 hr., set costing about \$1,500	0.60
Gasoline, $3\frac{1}{4}$ gal. at 18 c. per gal.	0.63
Oil, crankcase and hoists, 0.3 gal. per hour at 75c. per gal.	0.23
Grease and greasing labor	0.10
Driver	0.75
	\$3.05
Total Hourly Expense for Ownership and Operation	\$4.73



SHOVEL DIPPER loads last bucketful of ore on 18-ton load. Loading time averages 3.5 min.

Side-dump bodies are 7-cu.yd. water-level capacity with inside dimensions $14\frac{1}{2}$ ft. long, 8 ft. wide and $19\frac{1}{2}$ in. deep. Twin hoists under each body, illustrated by a photograph, are four-stage telescopic. Each unit is equipped with ten tires, 11.25 x 24, 14 ply.

Weight of the hauling unit is about 30,000 lb., and the approxi-

mate delivered price is \$14,700. Total weight of the unit and load is approximately 66,000 lb. The power factor, obtained by dividing engine displacement by gross load, is 17.6 cu.in. per ton.

Unit Cost—Unit cost is the quotient obtained by dividing average production into average cost of ownership and operation. In this discussion the unit of time is selected arbitrarily as the hour. Hourly cost of ownership and operation, as indicated in the accompanying typical field study, is determined by uniform methods which are applied without modification in figuring hourly costs of various units built by different manufacturers. It is assumed that the several manufacturers of heavy-duty hauling equipment build quality products which justify uniform treatment of allowances for depreciation, repairs and replacements. The same method will be followed in succeeding chapters of this group of articles.

Truck-Mounted Pneumatic Hammer Demolishes Pavement



AN AIR-POWERED PAVEMENT BREAKER mounted with a compressor on a revolving turntable above the rear end of a truck, smashed street pavement for the P. W. Graham Contracting Co., Cleveland, on a section of interceptor sewer being built by the Buffalo, N. Y., Sewer Authority as part of its \$15,000,000 program. The same pavement breaker served contractors on other sections of the sewers.

Highway Maintenance and Construction Details

*From Many
States*

*Photos by Courtesy of
U. S. BUREAU OF
PUBLIC ROADS*



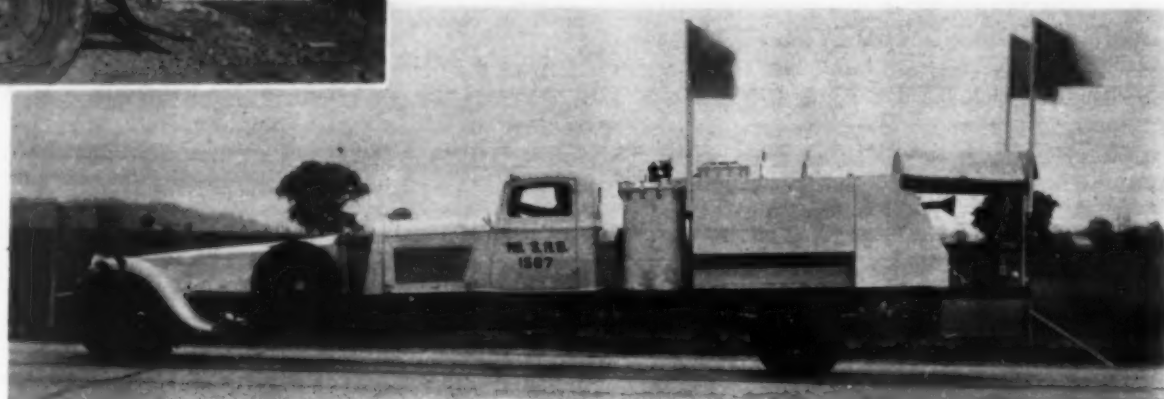
BROOM AND BLOWER UNIT serves Georgia highway crew in cleaning surface of stabilized soil road prior to surface treatment near Elkmont, Ga.



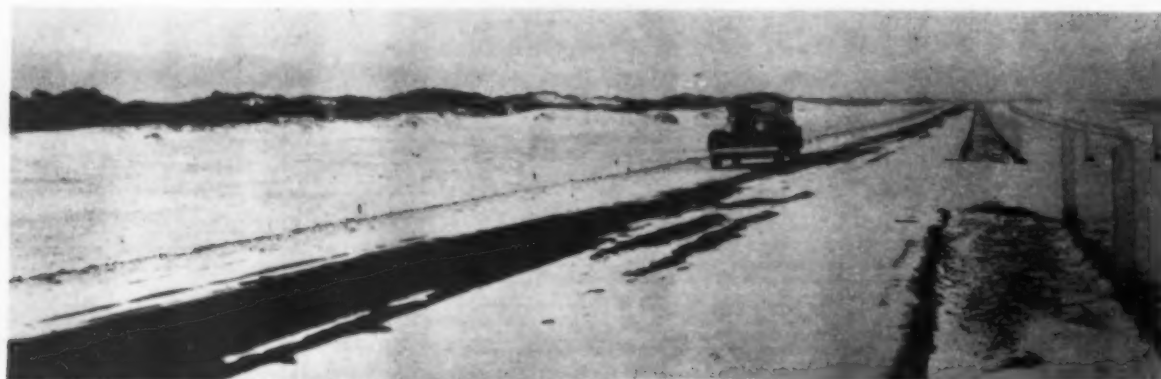
BRIDGE MAINTENANCE TRUCK of State Road Department at Fort Walton, Fla., carries built-in compressor and pneumatic tools in addition to full complement of other equipment needed for upkeep of bridges and small drainage structures.



MAINTENANCE WELDING TRUCK equipped with gasoline-engine electric generator set for arc welding transports on rear platform complete gas welding outfit mounted on separate three-wheel pneumatic-tired buggy.



TRAFFIC STRIPING MACHINE of Missouri State Highway Department is carried on long-wheel-base chassis providing improved accuracy, greater capacity, faster operation and resulting economy.



NOT SNOW but blown sand (left) covers this stretch of sand-asphalt road along Gulf of Mexico on U. S. 98 near Panama City, Fla. Maintenance engineers have problem in keeping sand under control.

SAND-ASPHALT SHOULDERS (right) 4 in. thick, mixed in place and sprigged with Bermuda grass, stabilize soil and prevent blowing of sand on this portion of U. S. 98 near Panama City, Fla.

ASPHALT DITCH LINING 2 in. thick (below) prevents soil erosion and permits grass to take root. Grass grows through asphalt and eventually replaces it, leaving sodded ditch alongside U. S. 90 in Florida.



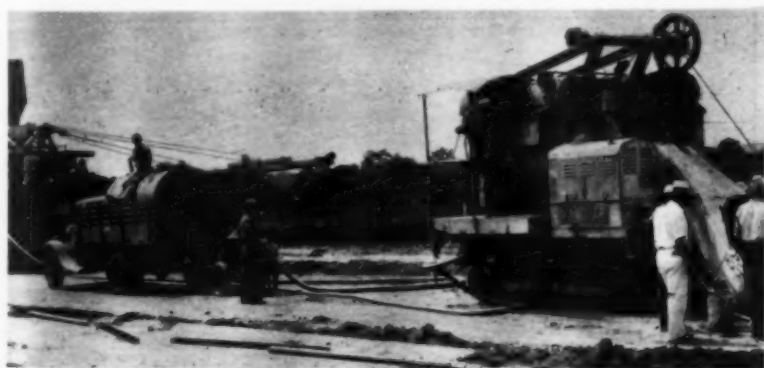
STONE SKIPS (right) ordinarily used in quarry operations serve for removing ditch excavation on Blue Ridge Parkway, North Carolina.



CULVERT DROP INLET of native stone masonry is feature of paved ditch along Blue Ridge Parkway, scenic route in North Carolina.



REFLECTORIZED SIGN directs traffic to proper roadway of divided-lane highway U. S. 40 between Aberdeen and Havre de Grace, Md.



WATER BY TANK TRUCK instead of by pipe line suttices to keep two mixers supplied on paving of U. S. 40 near Aberdeen, Md. Pump on small two-wheel truck feeds water from tank to two pavers.

WARNING SIGN (right) at barricade between two sections of Blue Ridge Parkway, North Carolina, advises wandering motorists to stay clear.

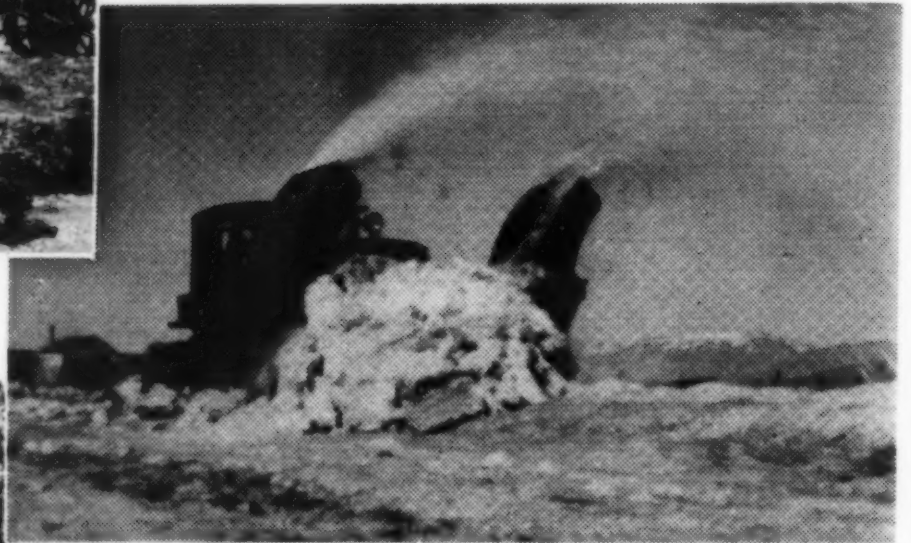


Highway Maintenance and Construction Details

... Continued



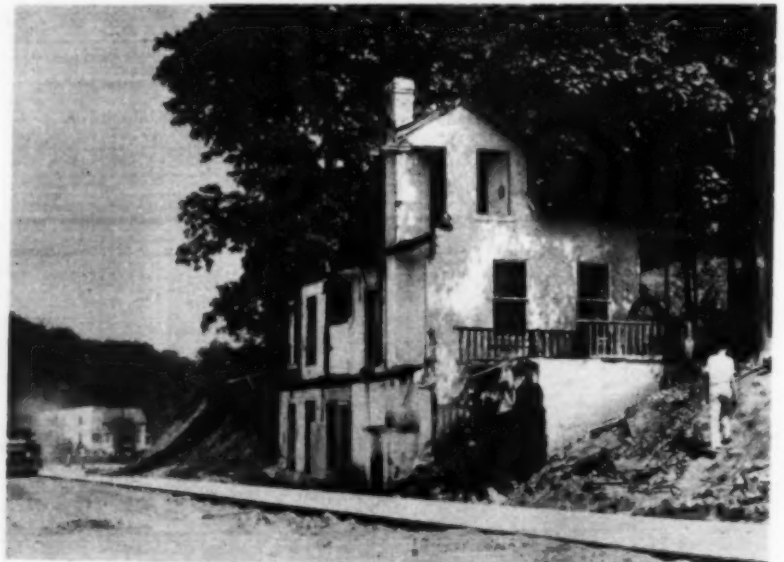
ROLLING STEAM BOILER on pneumatic-tired trailer thaws out culvert with steam jet near Barton, N. H.



V-PLOW WITH ROTARIES and snow chutes clears drifts on New Mexico roads. Centrifugal force of rotaries throws snow upward through chutes, relieving pressure on face of V-plow. Direction in which snow is thrown is determined by prevailing wind.



GUIDE STAKES marking edges of surfaced roadway aid maintainer operator in blading surfacing material on Blue Ridge Parkway in North Carolina.



HIGHWAY WIDENING of Lee Boulevard, Fort Myer, Va., requires amputation of half of house.



ONE METHOD of holding sand dunes along U. S. 98 near Panama City, Fla., is by utilizing old guard fence to form wire mat on slope.



DIVIDER SLABS 4 ft. long separate travel lanes and speed compacting of pebble soil stabilized surface by traffic near Graymont, Ga.

JOB ODDITIES

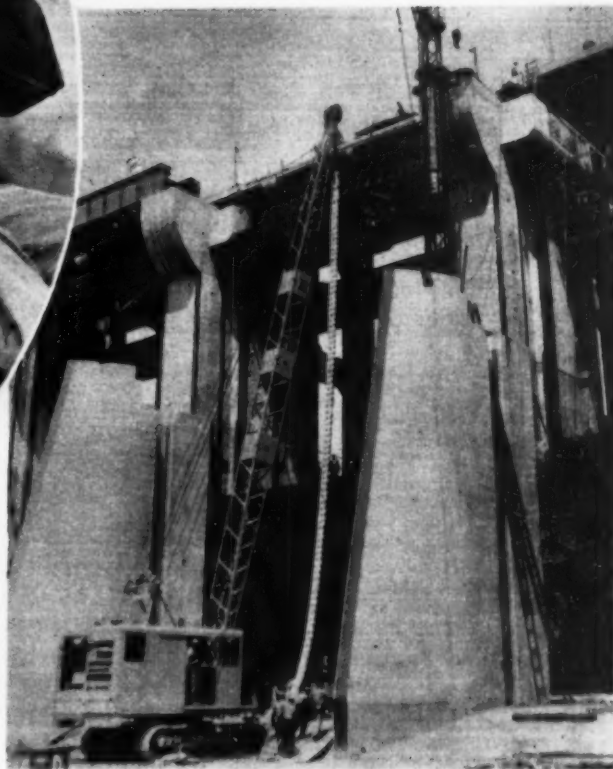
A MONTHLY PAGE OF
*Unusual Features of
Construction*



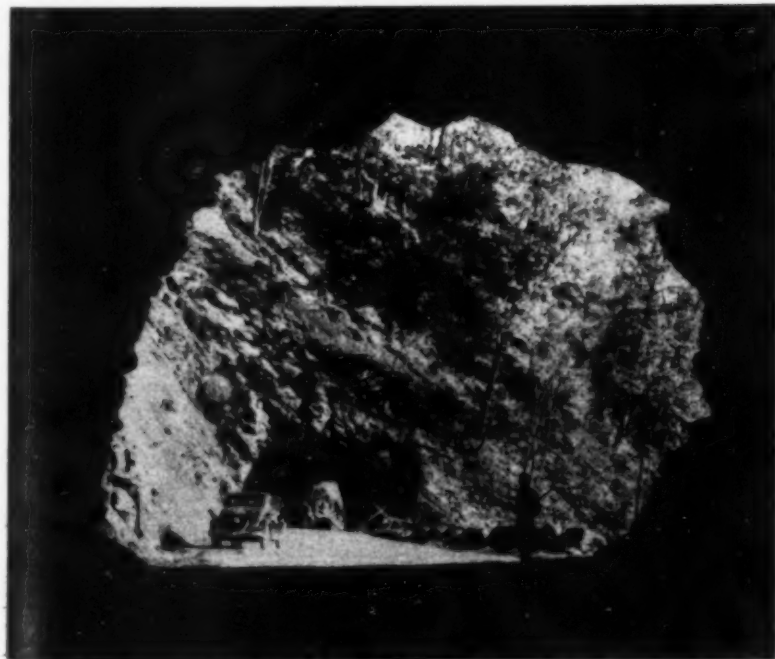
INCASED IN SCAFFOLDING. Victoria Tower of London's Houses of Parliament is undergoing extensive renovation.



NO SIT-DOWN STRIKE HERE! At Parker dam on Colorado River, in California, "Happy" Hepner, signal puncher, directs by telephone operation of cross-canyon cableway for J. F. Shea Co., contractor. He's the only man on the job, according to the Metropolitan Water District of Southern California, who makes his living sitting down.



SOME BICYCLE CHAIN for these boys! It's of stainless steel and is being installed by McKiernan-Terry Corp. to operate one of the huge steel flood-gates at the spillway of Fort Peck dam, which U.S. Army Engineers are building across Missouri River in Montana.



ON THE INSIDE LOOKING OUT. Shot from interior of 300-ft. tunnel being driven through rock on Blue Ridge Parkway, near Mt. Mitchell, N. C., by H. W. Anderson, contractor. Grading for 3.7-mi. section of mountainous route costs more than \$100,000 per mile. Photo by JACK C. BAKER, engineer with U.S. Bureau of Public Roads.



MOVIE DIRECTOR—So that's the costume you thought would be just right for this scene! What do you think a bulldozer is, Mr. Lovelace?

Multi-Plate Pipe

Cuts Cost of 13-Ft. 9-In. Siphon

In Wet Soil

By D. A. BUZZELL
Chief Hydraulic Engineer,
Tri-County Project,
Hastings, Neb.

WITH THE GROUND WATER LEVEL only 5 ft. below a streambed of fine sand and gravel, difficulties were expected and encountered in constructing Plum Creek siphon, part of the Tri-County or Central Nebraska Project, a \$30,000,000 power and irrigation project extending over 300 mi. of central and western Nebraska.

Shortly after leaving the diversion dam on the Platte River near Lexington, the main irrigation canal, of 1,500 sec.-ft. capacity, crosses a stream known as Plum Creek. Although usually dry, this creek has a drainage area of 300 sq. mi. and it occasionally discharges large quantities of storm water. Relative elevations of canal and streambed made the use of a siphon undercrossing imperative.

It was realized from the start that this crossing was certain to be an expensive one; so several alternative designs were prepared and cost studies made of each. The maximum hydrostatic head was found to be 24 ft., and this fact alone made a rectangular concrete box uneconomical. In addition to the heavily-reinforced design required, it would have been necessary to de-water the excavation and to keep it drained for at least three months in order to complete the concrete work below water level.

Next, a smooth steel plate design, stiffened with angles as in a penstock, was found to run high in cost, chiefly on account of the large amount of rigidity required to resist earth pressures when the pipe was empty. Although a circular concrete conduit would have served the purpose, it could not have been economically built in place with reliable expansion joints.

Another type considered was corrugated metal pipe, because of the rigidity and strength imparted to it by the corrugations. In the diameter required, 13 ft. 9 in., the effect of friction was not considered important.

Based on the advantages of strength, adaptability to shifting soil conditions, omission of expansion joints, speedy erection and saving in costs, Armco Multi Plate was adopted. Plans called for 290 ft. of 13-ft. 9-in.-diameter pipe of No. 1 gage ingot iron.

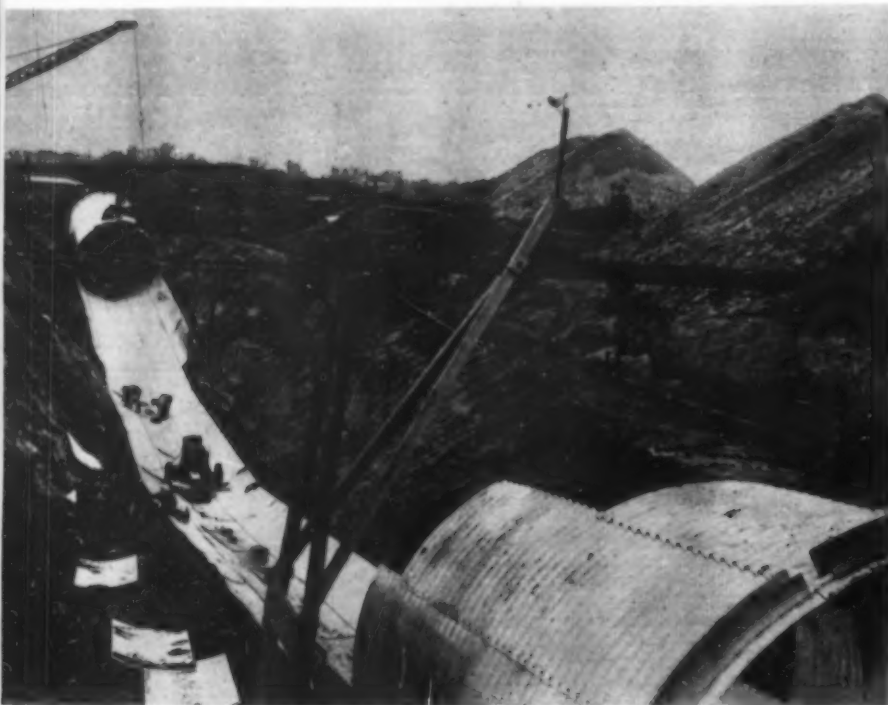
Our original plan was to have the entire conduit assembled above ground and then, by pumping the soil from beneath the barrel, sink it to grade. I am still convinced that this would have been by far the cheapest way to have handled this job but the contractor, unfamiliar with this type of structure, elected to drive well-points and de-water the excavation—thus assembling the conduit in its final position.

Construction Details—The accompanying illustrations show most of the construction procedure. Excavation was carried to a depth of 25 ft., mostly through waterbearing soil, thus necessitating the use of a system of More-trench well-points to a depth of 26 ft. around the entire excavation area, operated by two 2,000-gal.-per-min. pumps.

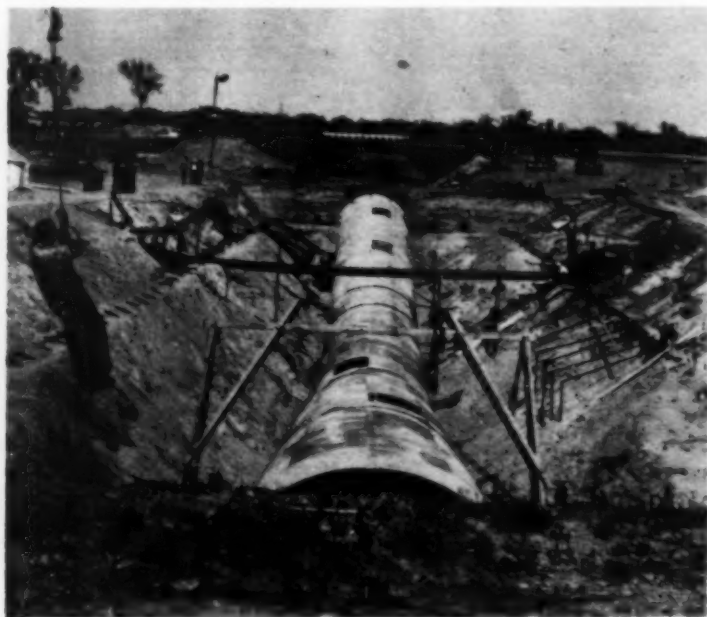
Plates were distributed along the bank by trucks and swung into position by the dragline, with its 50-ft. boom. This, by the way, was the only heavy equipment on the job. Three rows of plates in the invert were laid the full length of the pipe and then erection of the full circle proceeded from the inlet end of the pipe. Portable



WELLPOINT SYSTEM for keeping trench dry involved two 2,000 g.p.m. pumps serving line of wellpoints 26 ft. deep around entire excavation.



PIPE ERECTION in 25-ft. trench was started by laying three rows of plates and welding joints in invert for full length of structure. Then erection of full 13-ft. 9-in. welded circle proceeded from inlet end.



DRY TRENCH for erection of Multi Plate siphon pipe is maintained by system of wellpoints sunk to 26-ft. depth.

staging or scaffolding facilitated the bolting and welding operations. The pipe was erected on heavy timber blocks to permit the outside seams to be welded from below.

It was felt that three coats of asphaltic paint inside and out would insure that very little leakage would take place through the plate laps, but to make doubly sure we finally decided to call for continuous welding of all seams both inside and out. The asphalt paint was applied after all seams had been welded, so that the pure iron base is protected by about $\frac{1}{8}$ in. of asphalt over the heavy layer of spelter.

Because all seams were welded and the bolt heads, too, just enough bolts were used to hold the pipe together in good shape for welding. In other words, special plates with a single row of bolts along each edge at 6-in. intervals were used. Transition structures of concrete were built at each end of the siphon.

Water-Tightness — It is interesting to note that when water was allowed to rise to a height of 10 ft. around the unbackfilled pipe and remain for a period of several weeks, absolutely no leakage could be observed. In order to equalize pressures during backfilling and to keep the structure from floating, it was necessary to pump water into the pipe.

As is customary for large flexible pipe structures under heavy fills, this pipe was "strutted"—the vertical diameter elongated slightly—to retain the true round shape during backfilling. After the compacted backfill of 6 to 20 ft. was completed, the struts were removed. The pipe showed no measurable deflection.

It is interesting to note that when water was allowed to rise on the outside of this structure a head differential of 10 ft. between outside and inside was held for several weeks, and the leakage was zero so far as anyone could observe. It was finally necessary to pump water into the conduit in order to equalize pressures before backfilling. During this backfilling the pipe was "strutted" to prevent flattening. After the backfill of 6 to 20 ft. was completed, the strutting was removed, and so far no deflection of the crown can be measured.

Cost Comparisons — Twelve thousand lineal feet of $\frac{1}{4}$ -in. fillet welds were placed at a cost of 29 c. per lineal foot of weld. Our preliminary estimates indicated that the Multi Plate structure should cost \$10,000 less than a concrete box or pipe. An analysis of the six bids presented shows that the average bid was \$6,728 lower for the Multi Plate than it would have been for a concrete siphon. One bid was \$14,969 lower on the Multi



STRUTTING was employed to elongate vertical diameter of pipe so that true round shape might be retained during backfilling. Joints were maintained only by one row of bolts prior to welding seams both inside and outside.

Plate. It is possible to make this comparison because two concrete siphons at other points on the canal were let at the same time, and the economy shown above is based on using the unit prices bid on these structures.

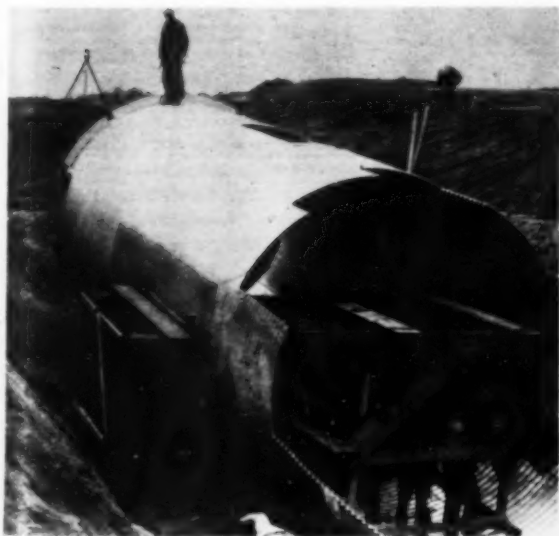
Personnel — Inland Construction Co. was the contractor on this siphon job. R. L. Boyce was resident engineer, under the supervision of George E. Johnson, chief engineer and general manager, the Central Nebraska Public Power & Irrigation District.

Advantages of Multi Plate Construction

- (1) It is economical because the cost per lineal foot is less than that for concrete. It requires about 10 per cent less excavation and can be erected in about one-half the time, thus saving overhead. Time is often an important element.
- (2) It is safer because there are no expansion joints to leak and allow unequal settlement. The omission of expansion joints causes a further saving in cost.
- (3) It is flexible and can accommodate unequal settlement due to variable soil conditions, and unequal surcharge loads of the backfill.
- (4) It is more easily inspected as every plate can be examined before being placed. So can each bolt, nut, and weld.



DRAGLINE, later used for backfilling, handled plates distributed along top of trench by truck.



PORTABLE STAGING was employed to erect corrugated plates of pipe and was moved along as work progressed.



OUTLET END of completed siphon across Plum Creek discharging into section of main irrigation canal.

PUT THIS ALLIS-CHALMERS *LEANING*

New, all-welded, twist-proof tubular-frame . . . scientifically designed to absorb the strains, stresses and shocks of grader operation . . . strong enough to hold the pull of any tractor. Leaning frame and long, shiftable rear axle provide greater working stability and permit a wider range of working positions than has ever before been possible in a grader. With the leaning frame you can shift the center of gravity, thus work on steep banks where other graders cannot even stick . . . when necessary you can lean the frame toward that end of the moldboard which needs extra pressure for shearing off roots or cutting through hard spots . . . in cutting flat slopes when crank and lift links have reached their effective limit the frame lean can be used to obtain an additional 25 degrees of moldboard rotation and extra, downward pressure for cutting. Operators say this new Leaning Frame Grader is the easiest operating grader they've ever handled. Put it to work on your grading jobs . . . watch it speed your operations and cut your costs. Now available in two power-controlled sizes—No. 110 with 10-foot blade—No. 112 with 12-foot blade.



Normal ditch cut. A level operating platform is possible in this position only with the leaning frame. If extremely hard digging is encountered, tremendous extra, downward pressure can be exerted on forward end of blade by leaning the frame to the right. You move only one control lever to accomplish this and, once hard digging is passed, you can quickly return the machine to its previous setting.

SEE YOUR ALLIS-CHALMERS
DEALER FOR MORE
COMPLETE DETAILS!



Finishing Flat Bottom Ditch. Any width ditch is easily and quickly obtainable. Here again the leaning frame can be used to place extra pressure on the blade for extremely hard digging.



Cutting a 1:1 bank. Frame lean enables operator to control grader's weight and so work on banks where ordinary graders cannot travel. Note that even on this steep slope a portion of the operating platform is level, enabling operator to handle controls in comfort.



Shoulder Finishing. Once blade is set to specified cross section, a uniform slope is assured by simply keeping the platform level through use of frame lean control. When speedy adjustment is necessary to clear culverts or other obstructions, lift arm and frame lean may be operated simultaneously.

NOTE TO OPERATORS

Position changes on this new grader are power controlled by **Natural Action** levers that operate with finger-tip ease in the direction most natural to you. That is, levers controlling movements from side to side, move left and right; those controlling vertical movements, move forward and backward. As a result operation is easy, almost instinctive. There are no combination controls—each movement is individually controlled by a lever in front of the operator. Use of several levers simultaneously speeds up work because resulting relative movements are exact and positive. The leaning frame enables you to keep a level operating platform that's comfortable to work on regardless of grader position. You'll do better work with less effort—continuous ditching with this machine is no more tiring than straight leveling with ordinary graders.

FRAME GRADER ON YOUR TOUGHEST JOB

**PROVE FOR YOURSELF THAT IT CAN DO MORE
WORK, OPERATE IN MORE POSITIONS, MOVE IN-
TO THOSE POSITIONS FASTER AND DO BETTER
WORK WITH LESS OPERATOR EFFORT THAN
ANY OTHER MACHINE NOW ON THE MARKET**

Normal offset bank cutting position.
Leaning frame keeps platform in level, comfortable operating position and distributes weight of machine over all four wheels—no bogging down because one wheel is overloaded. Once blade is set, the operator obtains uniform slopes simply by maintaining a level platform with frame lean control.



ALLIS-CHALMERS

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MODERN AND CONTROLLED MOTION OIL TRUCK-TYPE TRACTORS FROM 32 TO 36 H.P. ... TANKER AND SMALL
HIGH SPEED PATROLS ... DOWN BLADE GRADERS ... INDUSTRIAL WHEEL TRACTORS ... STATIONARY POWER UNITS
FROM 31 TO 162 H.P. ... TWO, FOUR AND SIX-WHEEL SCRAPERS, DOLLOPERS, TRAILBUILDERS, LOADERS, WINCHES
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ALLIS-CHALMERS MFG. COMPANY
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Please send me FREE descriptive
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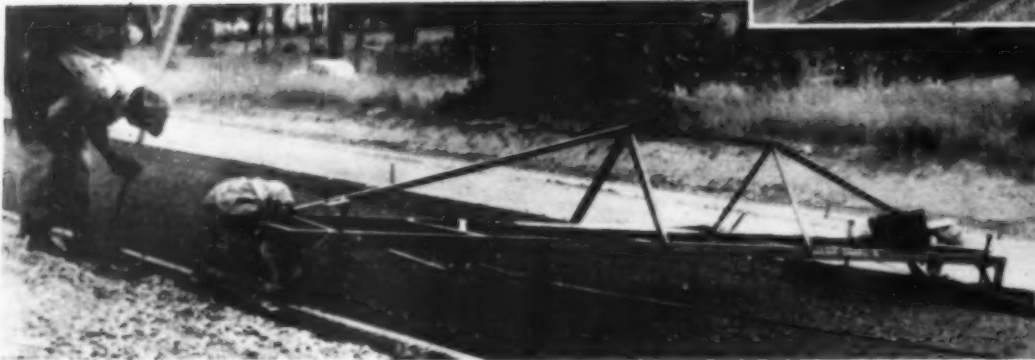
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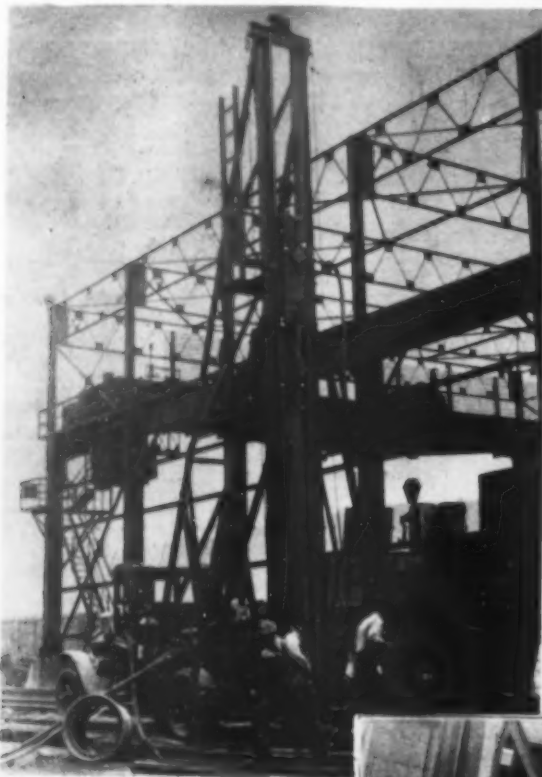
How They Did It

CONSTRUCTION DETAILS *For Superintendents and Foremen*



TRUSS DRAG, carrying inclined blades at each end, is hooked to rear of bituminous finishing machine to level off excess material and eliminate all hand work on base course. Blades are adjustable for depth at edges. Device is used by Basich Bros., contractors, on California state highway between Redwood City and San Mateo.

CANAL LINING, in form of bituminous mat reinforced with cotton fabric, is applied by Utah Oil Refining Co., at Grace, Idaho, using a Littleford utility spray tank, hauled by Monarch farm tractor. Canal has bottom width of 14 to 16 ft. and side slopes of 1 on 2. Application consisted of prime coat of $\frac{1}{2}$ - $\frac{3}{4}$ gal. of road oil, per square yard and tack coat of $\frac{1}{4}$ gal. per square yard of liquid asphalt, upon which cotton fabric was laid. Then followed an application of $\frac{1}{2}$ gal. per square yard of asphalt, covered by $\frac{3}{8}$ - $\frac{1}{4}$ -in. stone chips. After rolling, seal coat of 0.25—0.40 gal. was applied and covered with additional stone chips.



FOR DRIVING SHEETPIILING (above and right) on flood wall project at its branch plant in Steubenville, Ohio, Weirton Steel Co. used mobile rig mounted on chassis of Mack truck. Two upright channels served as guides for No. 6 McKiernan-Terry steam hammer. Two air hoists supplied power for handling hammer and raising piling into position for driving. With crew of four men this rig drove 1,400 lin.ft. of piling, making connections by hose to air and steam lines along line of construction. Truck carried burning outfit for cutting off ends of piling. — Photo from JOHN O. ROINEN, timekeeper and material man, Weirton, W. Va.



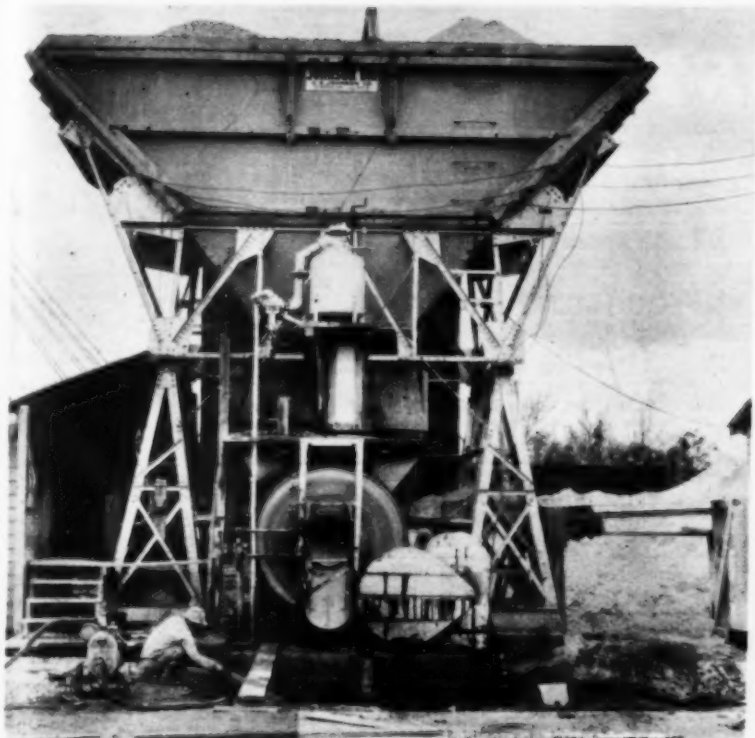
DESILTING EQUIPMENT at settling basins of Imperial dam on All-American canal project of U. S. Bureau of Reclamation near Yuma, Ariz., includes batteries of 125-ft.-diameter Dorr rotating scrapers, with capacity for handling 70,000 tons of silt every 24 hr. Contractors on \$4,374,240 project are Morrison-Knudsen, Utah Construction Co. and Winston Bros.



WANTED — Photos of Details

The Editor of Construction Methods wants photographs or sketches illustrating interesting **DETAILS** of method or equipment and will pay for those he finds acceptable for publication.

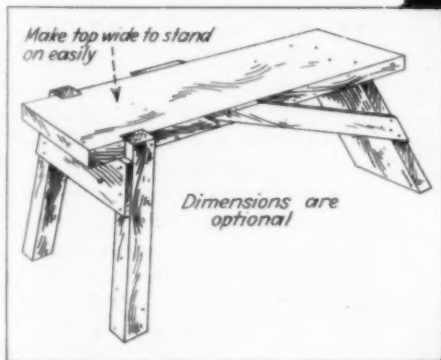
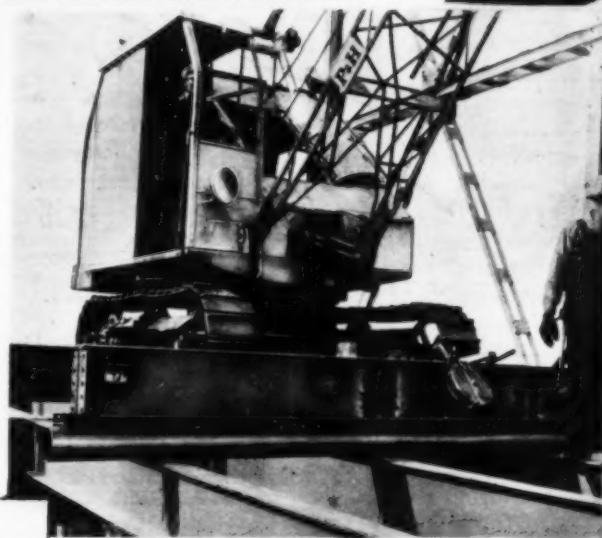
Hasn't your job produced some **DETAIL** that might be illustrated on this page? Send along a picture of it; we'll return it promptly if we can't use it.



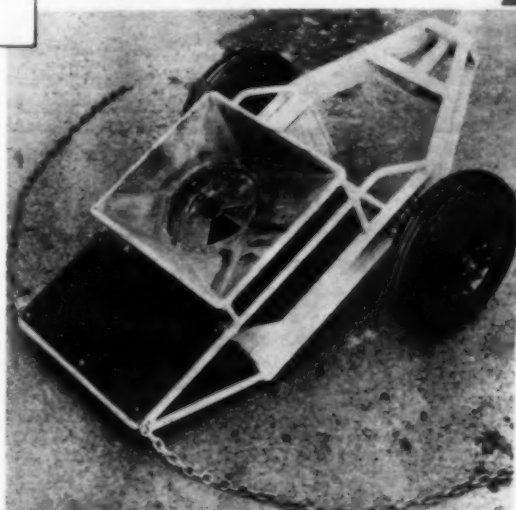
AUTOMATIC BATCHING PLANT serves Ransome 28-S concrete mixer on Mississippi River bridge project at Baton Rouge, La. Uvalde Construction Co., of Dallas, Tex., installs 76-cu.yd. two-compartment demountable Johnson bin, with two single material automatic Johnson weigh-batchers, equipped with full-reading dial scales and strip chart weight recorders, for sand and stone. Short feed chute delivers materials to mixer under bin. Use of single material batchers is designed for fast batching, since both sand and stone aggregates are batched simultaneously. One man operates mixer and dumps batches; another handles cement.



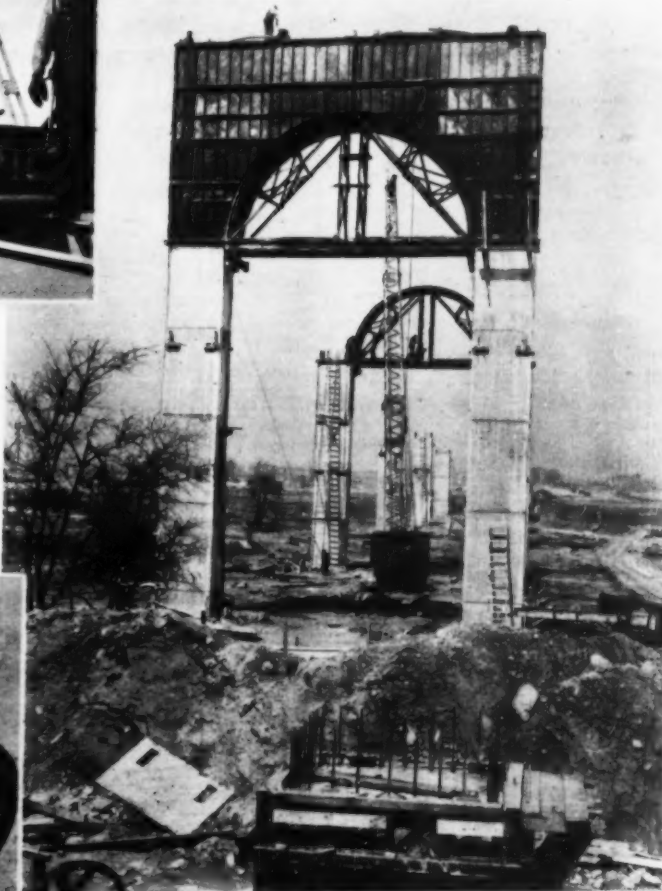
RIGGED AS A TRAVELER (above and left) this P&H bantam-weight crane, owned by Ottinger Construction Co., of Hinton, Okla., erected 180-ft. riveted steel truss and three 60-ft. I-beams for state highway bridge in Garvin County, Okla. Machine was mounted on I-beams placed at right angles to bridge stringers and supported by rollers in form of two lengths of 6-in. pipe. Crane boom 40 ft. long handled loads up to 10 tons.



WABBLEPROOF WOODEN HORSE (left), supported on three legs, is designed for use on uneven ground. Requires minimum of lumber and skill to build. The top plank should be wide enough to permit standing upon it. Dimensions are optional to suit job. — Sketch from **ANDREW VENA**, formerly with Carl J. Anderson Co., builders, New York, N. Y.



MECHANICAL SPREADER (right), designed by Oregon State Highway Department distributes sand and calcium chloride on icy pavements. Attached as trailer to dump truck. Spreader disks are revolved by power from traction of trailer wheels. Operating speed, 5 to 8 mi. per hour. Automatic clutch allows backing of trailer without operating drive mechanism.



STEEL ARCH CENTERS support steel forms for caps of two-column bents on Bronx-White-stone bridge, New York City, Corbetta Construction Co., contractor. Crane with boom extended to 115 ft. places half of arch center in position on bent in background. Note steel I-beam wales on column forms in foreground. Wales have welded end flanges set at 45-deg. angle for bolting.

DO BUILDINGS COST TOO MUCH?

FURTHER DISCUSSION OF ARTICLE BY ARTHUR F. COMSTOCK
IN CONSTRUCTION METHODS AND EQUIPMENT FOR APRIL

By MORTON C. TUTTLE

President,
Morton C. Tuttle Co., Engineers,
Boston, Mass.

IN THE article "Do Buildings Cost Too Much"? in *CONSTRUCTION Methods and Equipment* for April, Arthur F. Comstock reaches the conclusion that they do. He furnishes an interesting analysis of the cost of a New York City office building and expresses the opinion that material prices have not unduly increased, that building labor rates are too high and that voluntary codes of fair competition tend to raise wages and prices. Mr. Comstock suggests contractors' organizations as the agencies which should assume responsibility for correcting these increases.

For reasons which will be stated, it would seem that the selection of contractors' associations for accomplishing these reforms offers little hope of success. General contractors and subcontractors will not fight against conditions which do not adversely affect them. Until they reach a point where the buyers refuse to invest in buildings, rising labor and material costs offer no hardship to general contractors or subcontractors.

Other Savings Available

Mr. Comstock suggests but one possibility of reducing the cost of buildings, namely, by obtaining materials and labor at lower rates. There are available, although commonly neglected, other effective ways of reducing building costs. They are conventional in manufacturing procedure and have been applied to building operations. In both they have produced appreciable savings. Before discussing these methods it is worth while to make a realistic survey of the building industry.

Realistic View of Construction Industry

Under conventional procedure the general contractor is asked for but one thing—to name the price at which he will deliver a building

described by plans and specifications. In the creation of the design the general contractor has no part. The scope and quality of the work to be furnished are described by the architect and are subject to his inspection. Whether the plans and specifications represent the maximum of economy or the extreme of extravagance is a matter of indifference to the general contractor.

Who Builds a Modern Building?

Years ago, when buildings were simpler, a master builder with his own men actually constructed buildings complete. As building construction became more complex the number of subcontractors increased. As shown in Mr. Comstock's analysis, most of the actual construction of a building today is done by thirty or more subcontractors. Commonly, every visible part of a modern building is the work of subcontractors.

In the type of office building under consideration, the general contractor's payroll seldom amounts to more than 15 per cent of the total cost. *Thus, the general contractor is a buyer of materials and subcontracts the cost of what totals 85 per cent or more of the entire cost of the building.* Accordingly, under lump-sum bidding practice, the general contractor's hope of profit lies in close buying. From shrewd buying rise many of the ills of the building industry. But, as Kipling says, "That is another story."

Who Pays and Who Cares?

As the bids on a job are based on current labor and material prices, the general contractor, the subcontractors, and material dealers pass on to the owner periodic rises in wages or material costs. If there has been a wage increase of 5 per cent, this extra cost will be included in the estimates of all trades affected. So long as increased cost of labor, materials and subcontracts can be passed along, neither the general contractor, the subcontractors, the material men, nor the architect suffers thereby.

The general contractor and the subcontractors do fear that during

the progress of the job they may be compelled to pay higher than estimated rates. When an unanticipated rise in labor rates occurs during the operation, the owner is commonly an advocate of the contractor's making concessions that will permit the completion of his work.

Thus, before work starts, the general contractor and the subcontractors are concerned only with maintaining wages for the duration of the job. After work starts, the owner is indifferent to any wage increases, because these will be paid by the general contractor or by the subcontractor, without cost to him. Until such time as owners refuse to buy, there is small hope that contractors' associations will feel the urge wholeheartedly and effectively to fight labor and material increases.

If Construction Were Operated Like Manufacturing

Under accepted manufacturing theory the owner would reason that a proposed building was a new product, that the planning of any new product demanded the abilities not only of designers but of men skilled in costs, purchasing and operating. Knowing that the cost of any product depends primarily upon what goes into it, he would insist that the preliminary sketches of the proposed building be subjected to the constructive criticism of all these agencies.

First, Count the Cost

Before going to the expense of making finished plans the owner would determine within fairly narrow limits the cost at which he could produce a building of the sort being considered. For this estimate he would turn to his cost and operating departments. He would be distrustful of optimistic guesses and vague assurances from the designing department.

Seldom are building schemes subjected to as competent and thorough scrutiny as is given proposed manufacturing designs. Few cautionary signals are set in the path of the man who proposes to build. Real estate men, architect, general contractor, subcontractors and material men benefit by work going ahead.

No one waves a hat when there is a hen on.

Conventionally, the owner relies on the architect's estimate. There are exceptions, but few architects are competent estimators. Architects seldom have access to cost information. They are seldom experienced buyers. Even so, the architect's estimate is the sole cost basis for most building schemes. No manufacturer would accept similar unchecked figures offered by his designing department. Incompetent preliminary estimating is a just cause for criticism of our building industry.

Who Does Know Cost?

The particular stock in trade of the general contractor is a knowledge of costs, building methods, buying and management. His work parallels that of the manufacturer's production, purchasing, and cost departments.

Translated into manufacturing terms, the plans of a building—a new product—go directly from the designing room into production. The work of the building designer is not constructively reviewed by the cost, purchasing and operating departments. That failure to review a building design neglects an opportunity to save cost is demonstrated when the bids for a proposed building exceed the appropriation. Then the general contractors and subcontractors are asked to make suggestions for reducing cost and the savings effected thereby are oftentimes astonishing. It is true that under these conditions value is often sacrificed, but the fact stands clear that the general contractor and subcontractors did offer recommendations for economy which were overlooked by the designers.

Lack of Teamwork

Construction is not a coordinated industry. It is divided into non-cooperating agencies—designers, builders, and subcontractors—agencies that do not, as in manufacturing, work as a team, each applying its particular ability and energy to the problem of producing a design that combines maximum economy and efficiency.

Rather, each works in a separate, isolated compartment. The designer

makes the plans and specifications. He asks the general contractors for their lowest price. The general contractors hunt the lowest bids from subcontractors and material men. A bond is required to guarantee, among other things, acceptance of the designer's interpretation of specifications. Accordingly, the vital interest of general contractor and subcontractors is focused, not on the owner's problem, but on their own task of getting the job done at the lowest cost.

Results — Not So Good

The whole procedure is a hunt for price rather than for value. It has worked so badly to the disadvantage of the owner that it has become conventional to exclude from competition the contracts for heating, lighting, plumbing, electrical work and painting, where inferior workmanship and material readily show up. The subcontractors for these installations are commonly selected by the architect. That this procedure should be considered necessary to insure value and satisfaction for these parts of a building is an arraignment of the conventional bidding system.

In the typical case we are studying, the general contractor is a buyer for 85 per cent of the cost of the building for which he has contracted. If it is logical to buy plumbing, electrical work, heating, and painting on other than a price basis it would seem logical to buy the twenty-six other subcontracts on other than a price basis. The owner can trust the architect to select subcontractors because the architect is hired on a fee basis, acts as the owner's agent and can be counted on to act solely in the owner's interest. The builder can not be so trusted, because his contract is made on a bid price basis and his interest, accordingly, is not the owner's. It is focused on low price.

The Story of a Great Builder

Three generations ago an already successful building firm reasoned that a more useful and satisfying business could be developed by operating in a way that would protect them against unreasonable financial risk and put them in a position to serve the owner's interest. Accordingly, for an agreed fee, this building firm became the owner's agent. They worked with the architect in developing an economical and practical design. They put at the disposal of architect and owner their experts in cost, in buying and in construction methods. They enabled the architect to proceed with assurance that the cost of his design would be within the appropriation. The arrangement assured the owner that each detail of the

design had been scrutinized for simplicity and value. Under the arrangement the owner knew that the buying of material and of subcontracts was in his interest, on a basis of value rather than on low price alone.

Years of successful construction management has resulted in their winning the reputation that no one can get a poor building job if they handle the work.

The Basis of Success

The success of that firm is based on its recognition of the fact that it is futile to try to build economically a structure that is extravagantly designed; that it is illogical to expect to obtain value through a hunt for the lowest priced materials and subcontracts; that it is futile to expect cooperation from architect, builder and subcontractors when the architect's mind is focused on value and the others are concerned only with making a profit on a bid price.

The saving obtainable by coordinating the work of designer, builder, and, as far as may be, of subcontractors has become increasingly recognized. More work each year is handled on this basis of service cooperation. The results have been so satisfactory that the building firms who have gained a reputation for effective work under this procedure have established a following of regular clients who give them their building work year after year. This would not be the case if their work had not produced economy and satisfaction.

There is no intention to suggest that every builder has the ability or the organization to cooperate effectively on the design of a new building, nor that every technically competent builder possesses the integrity, reliability, skill and energy which would mark him as a suitable agent.

Our own experience proves that a properly administered agency contract will produce savings, both in cost and in value. The opportunities for such savings are at four points:

- (1) *From double checking the owner's basic data as to space requirements.*

Oftentimes an independent recheck of an owner's requirements develops the advisability of a building of a different size and shape from that proposed. Twice in our experience such checking has proved that no building was advisable.

- (2) *From simplification of design.* In our own experience we have obtained as much as 10 per cent savings by making a thorough cost analysis of the design with suggestions for available economies in materials and methods.

- (3) *From an increase in the value of the structure resulting from wise buying of materials and subcontracts.*

Data regarding the relative upkeep of buildings are, unfortunately, not available, but examination of well designed and well built structures offers visible proof of the savings in upkeep.

- (4) *From efficient management of the entire building operation.*

A building operation manned by high-grade subcontractors moves faster and with less friction than does an operation on which there is even a sprinkling of inefficient subcontractors. Time, which means interest on the investment, is the source of this saving.

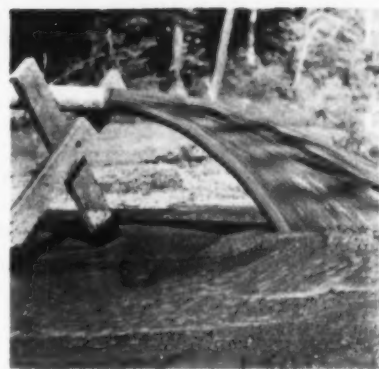
Floating Tractor-Driven Pump Dredges Sand for Road Maintenance



FLOATING CENTRIFUGAL PUMP driven by tractor riding on oil-drum raft dredges sand for Virginia road maintenance.

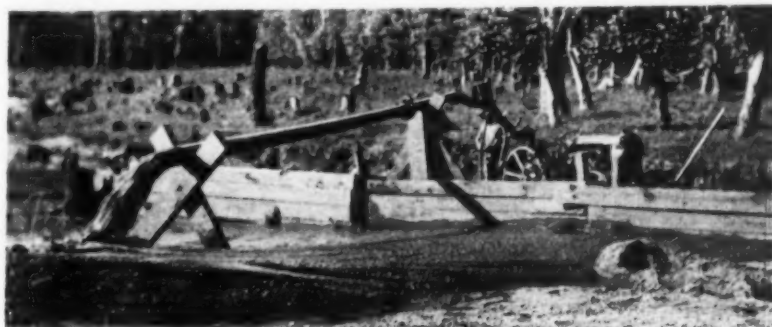
A SMALL HYDRAULIC dredging outfit consisting of a tractor-driven pump mounted on a barrel float produces sand from local streams for maintenance of bituminous and earth roads in Virginia. A suction hose from the pump picks up sand from the stream bottom, and a discharge line made up of flexible hose and a short section of pipe delivers the material to a pool on the bank where the sand settles and is retained by a plank dike. Properly operated, the dredging unit produces a clean sand.

Oil drums are used to build the float on which the small tractor and pump are mounted. A second pontoon of oil drums supports the suction hose and aids the maintenance crew in moving the intake end over the stream bed.



CLEAN PRODUCT for use on bituminous treatments and on earth roads is obtained by careful operation of pumping outfit.

Sand obtained with the pump is used for covering bituminous surface treatments and for top dressing on earth roads. C. S. Mullen is chief engineer of the Virginia Department of Highways, and J. J. Forrer is assistant engineer in charge of maintenance.

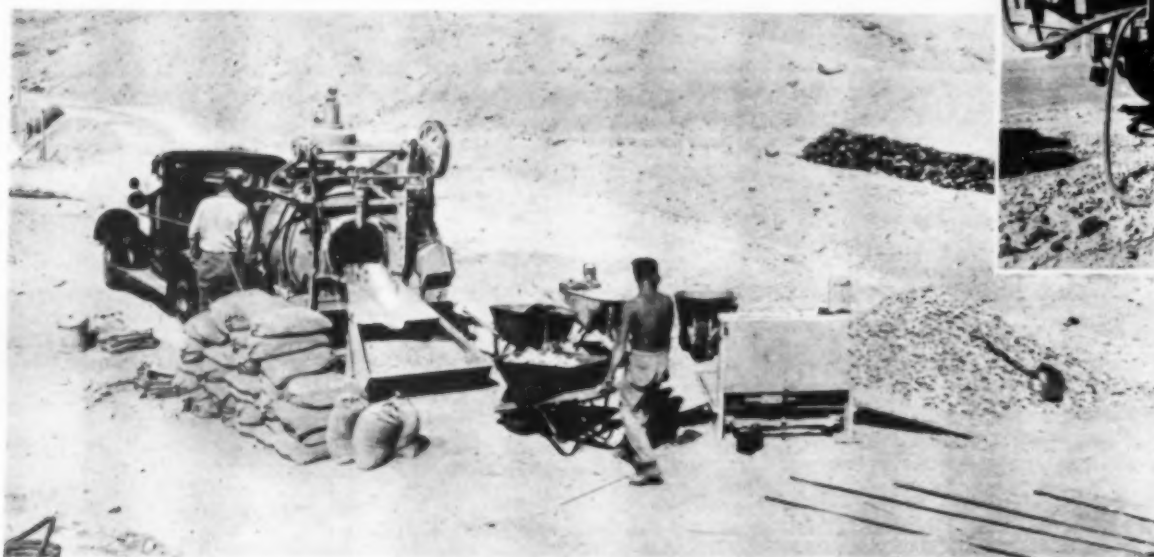


DISCHARGE PIPE dumps effluent on bank where sand accumulates against plank barricade.



1 JACKHAMMERS, served by portable compressor on canal bank, loosen hardpan prior to drilling fence post holes.

How Aqueduct Builders Erect 154 Miles of Fence



3 MIXER prepares concrete which is placed around lower ends of steel posts to form plug 14 in. in diameter and 2½ ft. deep.



2 TO SOFTEN surface material, prior to boring post holes, water under pressure is forced into ground for several feet by pipe connected by hose to tank truck.



4 AGGREGATES AND CEMENT for concrete plugs in post holes are proportioned in batching plant on rear end of truck.

FOR THE PROTECTION of canals and reservoirs along the line of the 392-mi. Colorado River aqueduct and distribution system in California, work is under way on one of the largest wire fence construction projects in the country, involving erection of 154 mi. of 6-ft. fence at a cost of \$413,076 by the Metropolitan Water District of Southern California. Fences are being set up on both sides of 64 mi. of open concrete-lined canals on desert sections of aqueduct and will also inclose various reservoirs along the big water supply system.

Contracts for fencing have been awarded to three companies as follows: Anchor Post Fence Co., of Baltimore, Md., \$187,916; Los Angeles Fencing Co., of Los Angeles, \$63,620; and Pittsburgh Steel Co.,

of Los Angeles, \$161,540. The type of fence specified is a galvanized chain-link fabric supported by steel posts set in concrete. Of the total 6-ft. height of fencing the upper 2 ft. is formed of strands of barbed wire which in themselves total more than 750 mi. in length.

Constructed over relatively flat sections of desert, the canals of the Metropolitan aqueduct, which, when completed, will carry a billion gallons of water daily, are the only sections that are exposed. All other sections of the line are constructed in tunnels, conduits, siphons and pipe lines buried beneath the ground surface.

Post holes for fencing are being dug with portable motorized augers. Specifications require that steel fence posts shall be set in a concrete cylinder 14 in. in diameter and extending to a depth of 2½ ft. below ground surface. Along canals the posts are 2 in. in diameter, extending approximately 6 ft. above ground and are set on 12-ft. centers.

Crews of the three companies erecting fences are progressing at a rate of about a mile a day on each job. Accompanying photographs illustrate methods and equipment employed.



5 **INCLINED CHUTE** delivers concrete to rubber-tired wheelbarrows for placement in post holes.



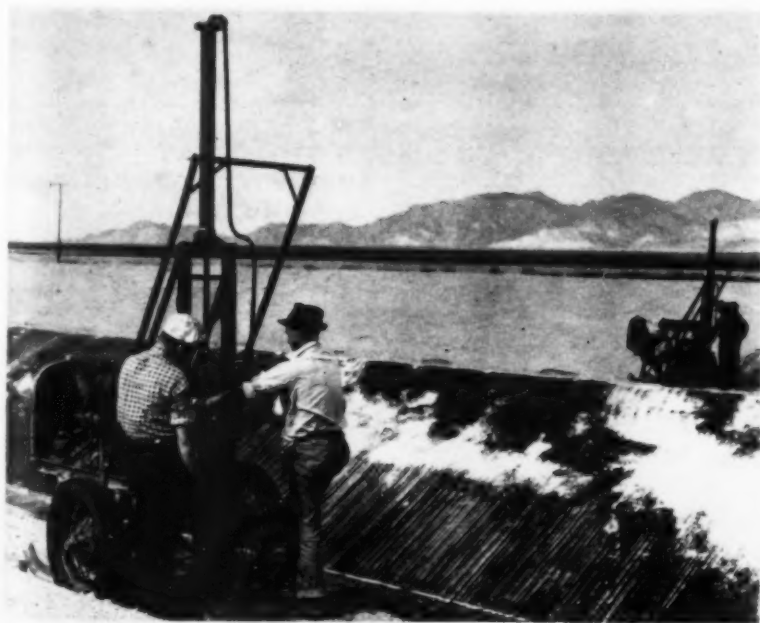
6 **STEEL POST** is held rigid by concrete plug, 14 in. in diameter and 2½ ft. deep, finished at top by hand troweling.



7 **READY FOR STRINGING** of wire and installation of wire mesh fencing, these steel posts are spaced 12 ft. on centers along canal bank.



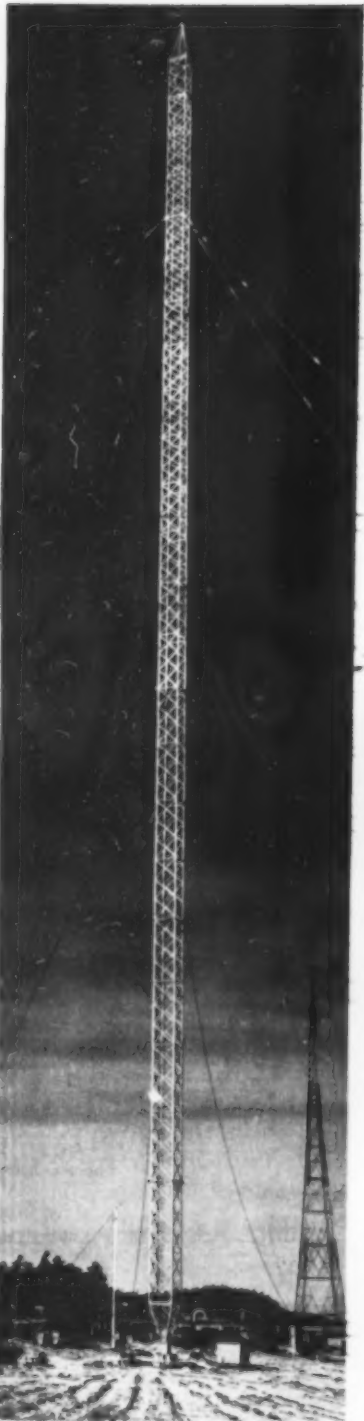
8 **FIRST WIRE** is strung on steel fence posts along section of canal.



9 **PORTABLE MOTORIZED AUGERS** mounted on pneumatic-tired carriage dig holes 14 in. in diameter and 2½ ft. deep to receive concrete plug in which steel fence posts are embedded.

10 **TYPICAL SECTION** (right) of completed fencing, showing 4-ft. height of wire mesh surmounted by four strands of barbed wire.





VERTICAL ANTENNA 625 ft. high is slender steel cage 9 ft. square terminating in point on insulator at base.

A NEW 625-ft. vertical antenna for General Electric's radio broadcasting station at Schenectady, N. Y., is a slender steel tower 9 ft. square erected by the American Bridge Co., contractor, with a basket boom. A feature of the tower, typical of modern vertical antennas, is its base support. The steel structure terminates in a point resting on a single porcelain insulator. This insulator, 4 ft. high, 20 in. in diameter at the top and 3 ft. in diameter at the bottom, weighs only 1,600 lb. but is capable of carrying a load exceeding 1,000 tons. The tower weighs 250 tons.

Construction of the tower was in



PORCELAIN INSULATOR weighing only 1,600 lb. supports 500,000-lb. tower and is capable of supporting more than 2,000,000 lb.



BOTTOM SECTION of steel tower is completely fabricated for erection on insulator, which has been sheathed by workmen to protect it from damage during tower raising.

Basket Boom

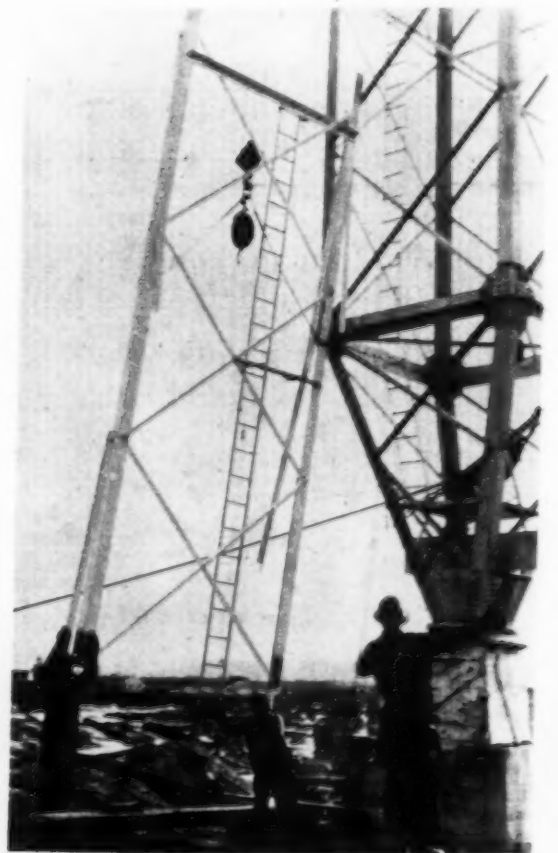
Erects

625-Ft.

VERTICAL ANTENNA

accordance with specifications approved by the aviation division of the Department of Commerce. The tower is a huge steel cage, guyed from the four corners at two levels and painted with alternate orange and white bands, with orange bands at the top and bottom. At the top is mounted a flashing red beacon, equipped with two 500-watt lamps burning simultaneously, and the tower carries additional red warning lights at three levels.

Supporting the porcelain insulator under the tower is a concrete base 10 ft. square which spreads out to reduce the bearing pressure to 3,000 lb. per square foot. Core



REMAINING SECTIONS go up one side at a time, being raised by hoisting falls from basket boom in tower.



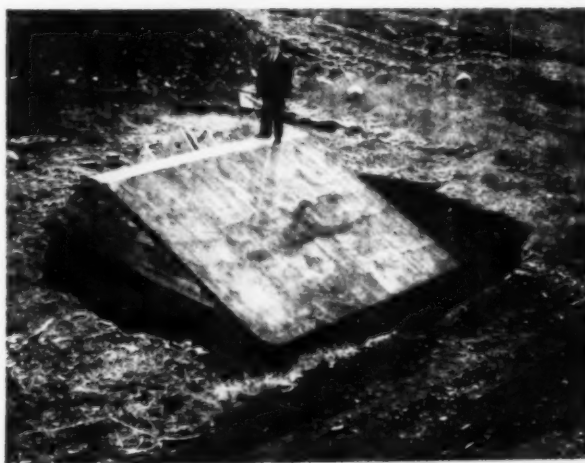
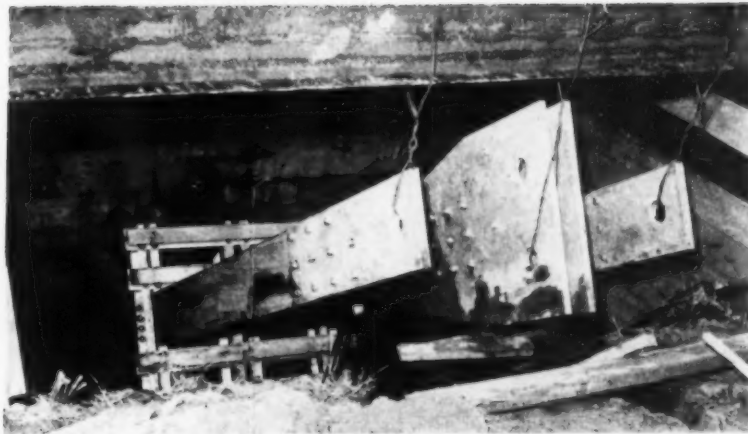
BASKET BOOM supported by rope tackle erects tower sections and moves itself up as work advances toward top.

borings to bedrock, 26 ft. below the surface, and bearing tests on the soil in a pit excavated 12 ft. below the surface satisfied the engineers as to the character and bearing capacity of the earth before the base was designed.

An elaborate grounding system forms an effective screen surrounding the base of the tower and minimizes losses in the earth, permitting all available radio energy to be concentrated in the outgoing signal. The ground system covers 20 acres and utilizes 13 mi. of copper ribbon, 1 in. wide and 0.015 in. thick. Strips of ribbon buried 18 in. in the ground radiate from the tower for distances of 625 ft. There are 120 strips in all, placed 3 deg. apart around the full 360 deg. of a circle.

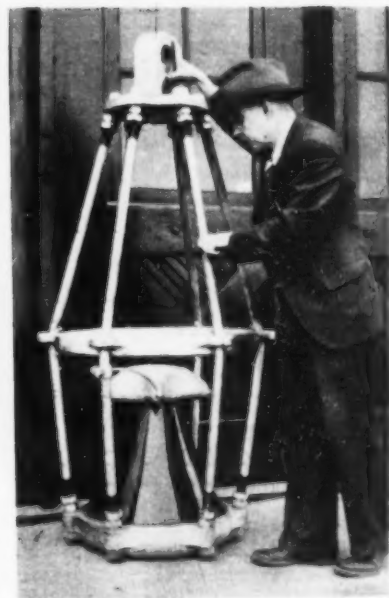
Balanced on its small insulator base, the tower is guyed by eight heavy steel cables, two on each side (one at the 500-ft. level and one at the 250-ft. level). The guys stretch

ANCHOR BARS (right) are supported in place for casting anchorage concrete. Two guy cables from one corner of tower will be anchored to these steel bars.



COMPLETED ANCHORAGE is concrete block incasing anchor bars.

LARGE INSULATOR (right) for cable guy is tall as man and weighs 700 lb.



SOCKET SHACKLE (right) is pinned to one of small insulators which break up guy cables. Note double-ply head protection for steel erectors in cold weather.

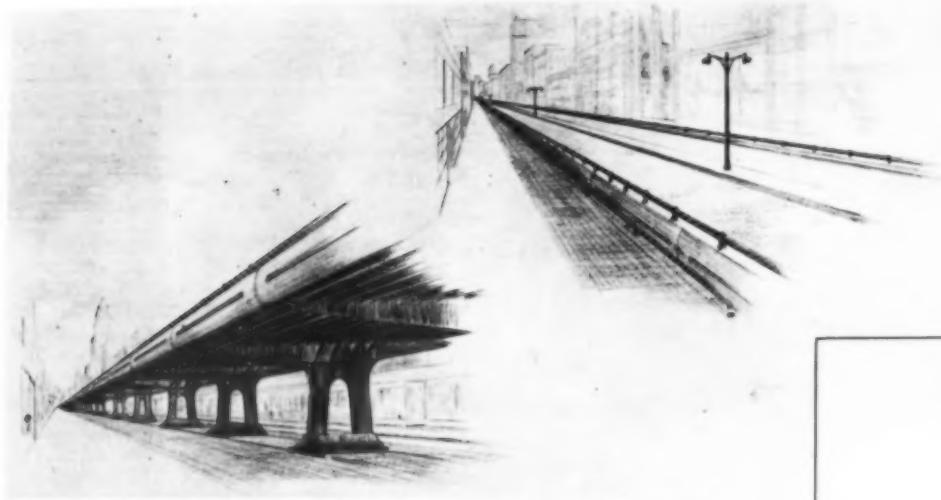


CONSTRUCTION SPEAKS ITS PIECE as steelmen get their turn before microphone when special broadcast is held on erection site.

out 450 ft. to concrete anchors buried in the ground. Each cable is strung with seven insulators to prevent any diversion of signal strength from the antenna. At the point of attachment to the tower, the guy is equipped with a 700-lb. insulator; then, at intervals along the cable, breaking it into separated segments, are six smaller insulators, each weighing 300 lb.

W. J. Purcell is chief engineer of WGY. The vertical antenna, fabricated and erected by the American Bridge Co., was expected to increase the effective signal strength of WGY's 50,000-watt transmitter at least three times, making it equivalent to one of 150,000 watts.

Prizes Awarded for Elevated Highway Designs

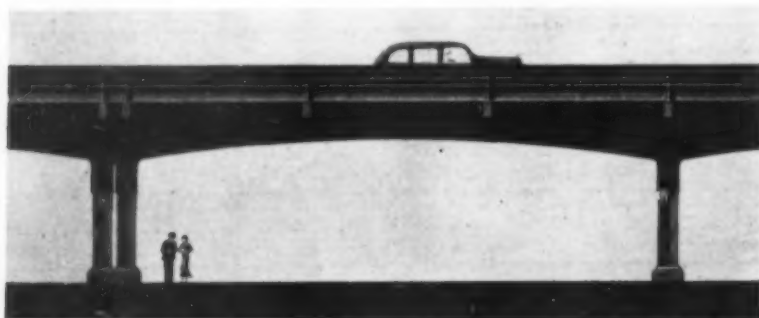


FIRST PRIZE of \$5,000 went to Hazelet & Erdal for four-lane roadway on cantilevered floor supported by central bent with spread legs.

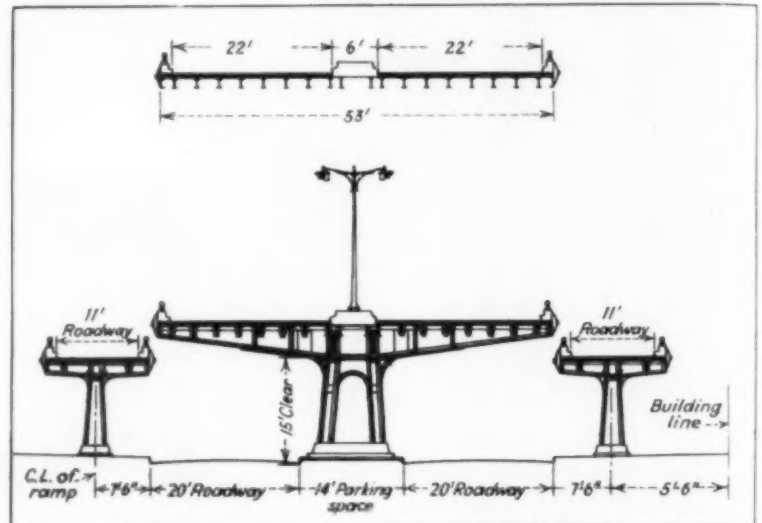
PRIZE-WINNING DESIGNS for elevated highways to relieve congestion and to speed the flow of traffic through densely populated cities have been selected from 273 entries submitted in a competition sponsored by the American Institute of Steel Construction. First prize of \$5,000 went to Hazelet & Erdal, consulting engineers, of Chicago. Their design shows a streamlined structure supporting a four-lane roadway upon a cantilevered floor beam supported on a central bent

which forms a safety zone in the street below. Such a design, it was believed, could be erected without causing severe property damage and without impeding traffic on the underlying street.

The second prize of \$2,000 was awarded to Madigan-Hyland, consulting engineers of New York, for whom E. H. Praeger is chief engineer and C. F. Lloyd, architectural designer. The design they submitted was that actually built for that portion of the new Henry Hudson Park-



SECOND PRIZE of \$2,000 was awarded for Madigan-Hyland's design (above and right) in which main girders are designed as three-span continuous girders. This design was actually built on Henry Hudson Parkway, New York City.



CENTRAL BENT SUPPORT for cantilevered floor of prize winning design.

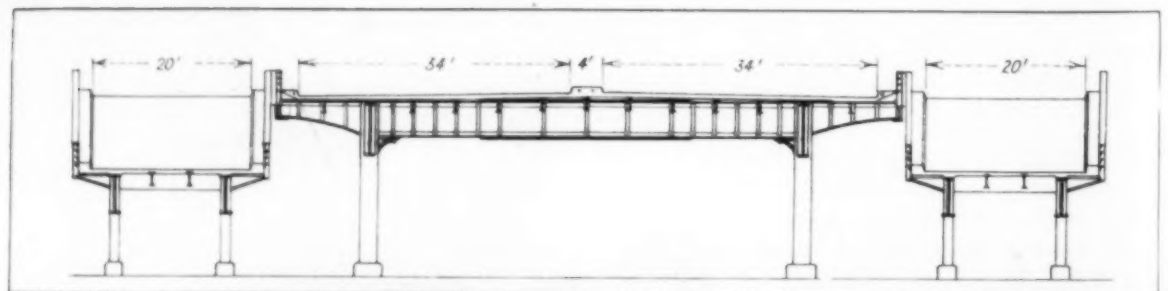
way between St. Clair Place and 135th Street, New York.

The third prize of \$1,000 went to Walter W. W. Jones, a New York City civil service employee with the title of engineering illustrative designer, Department of Borough Works, Office of the President, Borough of Manhattan, New York City.

Leading traffic authorities have been forced to the conclusion that the only permanent solution of this joint problem of accidents and congestion is through the construction of major

traffic routes particularly adapted to the operating characteristics and potentials of the automobile. Thus, they have projected a type of highway design to have the following physical and operating features:

1. It provides for a complete physical separation of streams of traffic moving in opposite directions.
2. It eliminates any direct access to abutting property.
3. It provides for an elimination of all intersections through a complete, continuous grade separation.



THIRD PRIZE of \$1,000 for design (left) went to Walter W. W. Jones, engineering designer in the office of the Borough President of Manhattan, New York City.

4. It provides decelerating lanes for vehicles slowing to leave the highway at specially provided exits and accelerating lanes for vehicles entering from specially provided entries.

Traffic routes of this type of construction have already demonstrated their ability to carry safely large volumes of traffic through congested districts at open highway speeds. Several cities are now projecting comprehensive systems of this type.

Engineers and Constructors on Neches River Bridge, Port Arthur, Tex.

(DESCRIBED IN AN ARTICLE LAST MONTH)



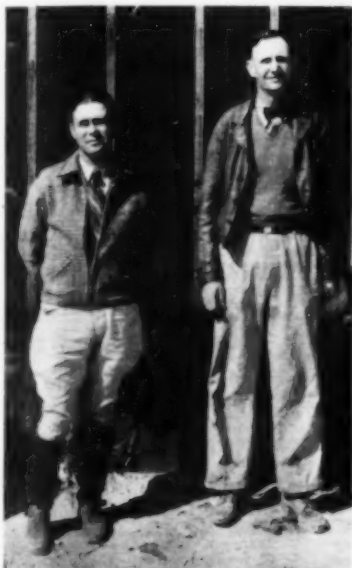
SUPERSTRUCTURE of Neches River bridge, Port Arthur, Tex., is erected by S. D. KAPELSOHN, construction manager, for Taylor-Fichter Steel Construction Co., New York City, contractor.



ENGINEER IN CHARGE of \$2,750,000 bridge is G. G. WICKLINE, on temporary leave from former position as chief bridge engineer of Texas Highway Department, which lent him to project financed jointly by State Highway Commission, PWA, and Jefferson County.



CONSTRUCTION OPERATIONS are supervised by P. V. PENNYBACKER (in center), construction engineer and second in command on project. At left is W. R. SMITH, inspector, and at right, A. L. DULIN, assistant engineer.



APPROACH PIERS are built under subcontract by Austin Bridge Co., Dallas, Tex., with two resident agents in charge of operations at site, D. B. ASHWORTH (left), construction engineer, and W. (Bill) CRABTREE, superintendent.



INTERESTS OF PWA are represented at site by GEORGE E. COLE (left), resident engineer-inspector, and G. R. SENSABAUGH, assistant resident engineer-inspector.



WORK OF VARIOUS CRAFTS on approach piers is directed for Austin Bridge Co. by this group of foremen: (left to right) C. D. AYERS, in charge of footings; G. S. BETHEA in charge of carpenters; J. L. OGDEN, reinforcing steel; HERBERT KELLY, concrete; M. T. TAYLOR, rigging.



ENGINEERING STAFF includes as part of its effective force: (left to right) R. O. LYTTON, assistant engineer; B. P. GREENWADE, assistant engineer; C. H. EDWARDS, inspector; S. E. ROPER, assistant engineer.



GENERAL SUBSTRUCTURE CONTRACT is executed by Union Bridge & Construction Co., Kansas City, Mo., with these men in charge of operations: (left to right) C. A. NEAL, president; CHARLES D. DONOVAN, chief clerk; S. A. DECKER, timekeeper; W. S. REEDER, engineer; O. S. SOLLARS, superintendent.

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these Faster-Driving*
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PILE SHELLS**

● Regardless of the driving formula employed, you can cut your driving costs up to fifty per cent by using Union Metal Fluted Steel Pile Shells for cast-in-place concrete piling.

The weight of these shells is far less than that of usual types of piles. Faster driving naturally results because there is less inertia for the hammer to overcome. Actual experience indicates that these light-weight shells require only approximately half as many blows to reach the desired penetration.

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CANTON, OHIO

Thirty-seven 36" Union Metal Shells serve as trestle piles for the Poplar Street Bridge, Johnstown, Pa. Engineers—State of Pennsylvania Highway Dept. and WPA.



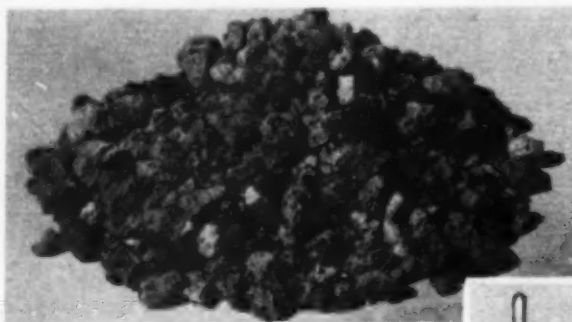
**EVERY
HAMMER
BLOW
COUNTS**

CONSTRUCTION EQUIPMENT NEWS

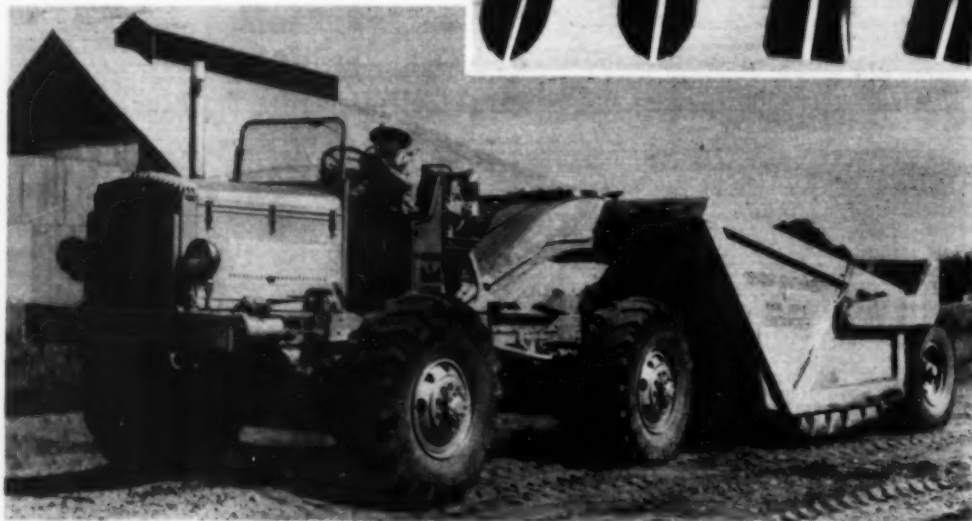
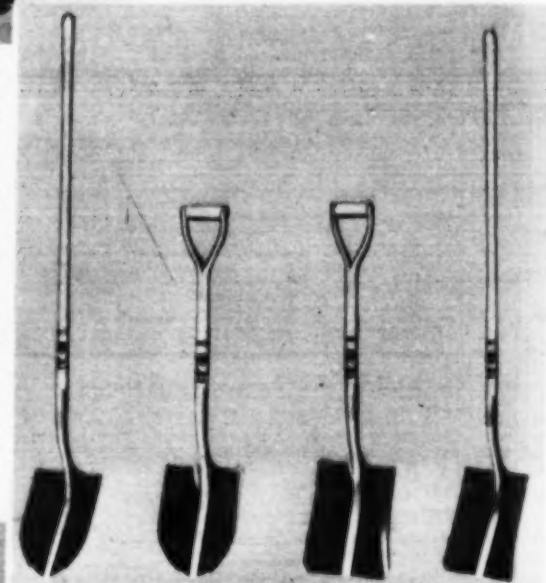
(ALL RIGHTS RESERVED)

Review of Construction Machinery and Materials for JUNE, 1938

LIGHTWEIGHT CONCRETE AGGREGATE — Product called Pottisco is manufactured by water treatment of molten basic pig-iron slag, a waste material of steel mills. Resultant vitreous clinker of porous, lightweight, cellular structure is crushed and screened to desired size. Has insulation, sound-absorption and heat-resistant qualities. Particularly suitable for monolithic or prefabricated use in fireproofing steel, for floor systems, long-span bridge decks, roofs, building tile for walls and in various prefabricated forms. Production facilities are maintained at Chicago, Youngstown, Ohio, Pittsburgh, Buffalo, Birdsboro, Pa., and Troy, N. Y. Costs are lowered by treating slag as it comes from the furnace, eliminating fuel costs. — **The Celotex Corp., 919 S. Michigan Ave., Chicago.**

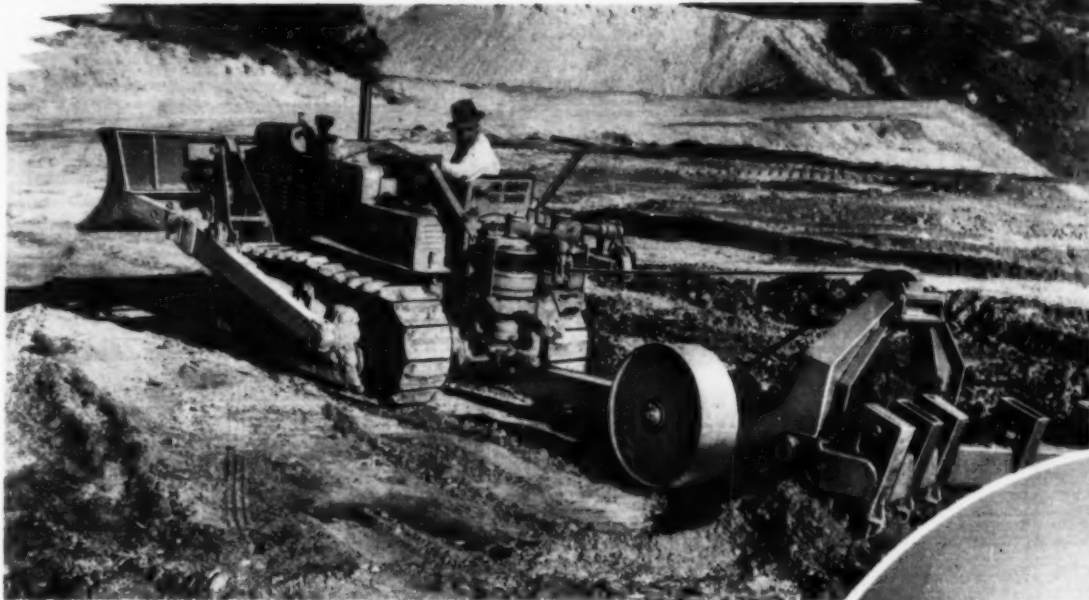


"RAZOR-BACK" SHOVELS, in four styles, have blade and socket forged from single bar of steel rolled to taper from center section to sides in order to produce 60 per cent greater thickness and strength through full length of center section, where wear and strain are greatest. Backbone extends full length from cutting edge to top of socket, combining strength of solid shank type with light weight of hollow-back type of shovel. Blades of special analysis steel are heat-treated for toughness and finished with anti-rust compound. Socket forms tube 9 in. long, accommodating full diameter of strength-tested white ash handle. Two rivets in socket have countersunk heads. Steel UD top allows for take-up, is welded at top for strength and is tapered for drive-on fit. Handle lengths, 27 and 48 in.; blade sizes, 8 3/4 x 12 in. and 9 3/4 x 12 in. Weight per dozen from 51 to 59 lb. Gold-painted stripe emphasizes full-length wide backbone. — **Union Fork & Hoe Co., Columbus, Ohio.**



HIGH SPEED SCRAPER UNIT, known as Oshkosh-Southwest four-wheel drive earth mover, is powered with four-wheel drive, four-wheel steer (air power), diesel tractor with low tractor ratio up to high speed of 35 m.p.h. Twelve speeds forward and three reverse, full floating axles, herringbone drop case with automatic locking center differential. Outstanding advantage of this unit is its maneuverability, which is said to be approximately same as crawler-type tractor. Further advantage: tractor applies full power to all four wheels regardless of position or angle of wheel. Same weight is applied to each tractor wheel, due to load distribution of entire unit. Hydraulic air-actuated brakes operate both on tractor and scraper wheels. Rapid-action cable winch operates scraper, permitting easy control of unit. Capacity, 14 yd. loose, 11.4 yd. bank measure. Power unit manufactured by Oshkosh Motor Truck Co., Oshkosh, Wis.; scraper unit by Southwest Welding & Manufacturing Co., Alhambra, Calif. Complete unit handled by **Oshkosh Four-Wheel Drive Sales Agency, Oshkosh, Wis.**

"HARD ROCK MEN"..



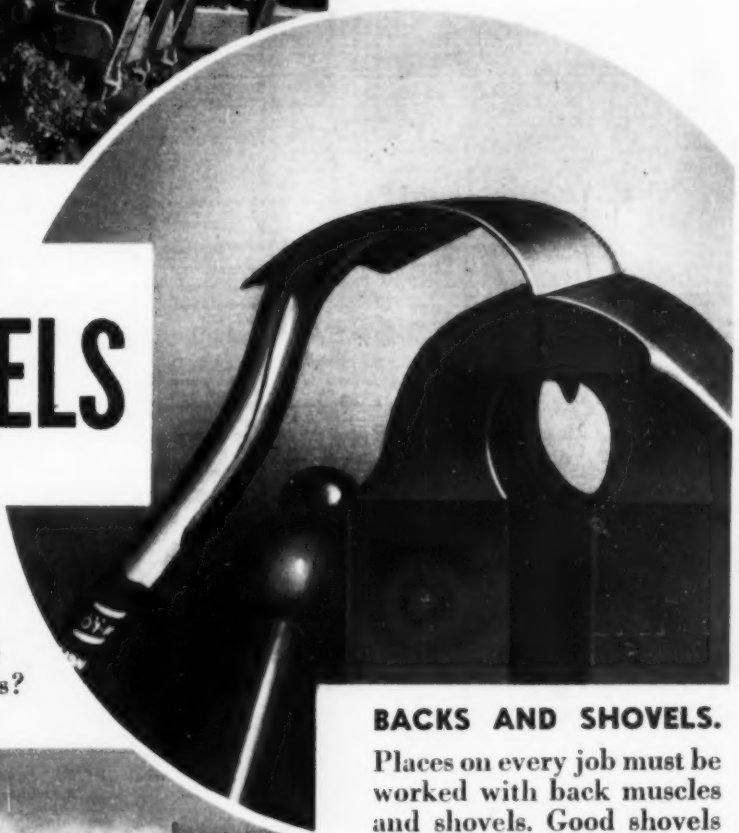
CUT AND FILL with this powerful Emsco Ripper. (Left) To overcome high stresses and shocks met in breaking hard-pan, shale and rocky soils, Emsco Derrick and Equipment Co., Los Angeles, uses SAE 3135 and 3140 heat-treated Nickel-chromium steels in axles and sheave shafts of this Emsco Ripper. The Cletrac tractor which powers it also makes use of Nickel alloy steels for vital parts.

THESE NICKEL ALLOY STEELS

LUCKY is the engineer whose foremen are tough, tireless, "hard rock men". Lucky is the engineer whose machines and equipment are toughened and strengthened by Nickel alloy steels and Nickel alloy cast irons. Luck is partly in learning the right alloy for the right place. Why don't you learn how Nickel solves tough operating problems?



61 TONS PER TRIP! This Mack truck with LeTourneau body (above) hauls 61 tons of muck at Bonneville Dam, makes 25 m.p.h. on return trips. To assure strength with minimum deadweight in earth moving equipment, nothing surpasses the demonstrated sturdiness and wear resistance of Nickel alloy steels.



BACKS AND SHOVELS.

Places on every job must be worked with back muscles and shovels. Good shovels utilize Nickel alloy steels for longer wear against abrasive materials, for springiness and toughness to resist breaking—and for welcome lightness with strength which permits better balance and easier shoveling.

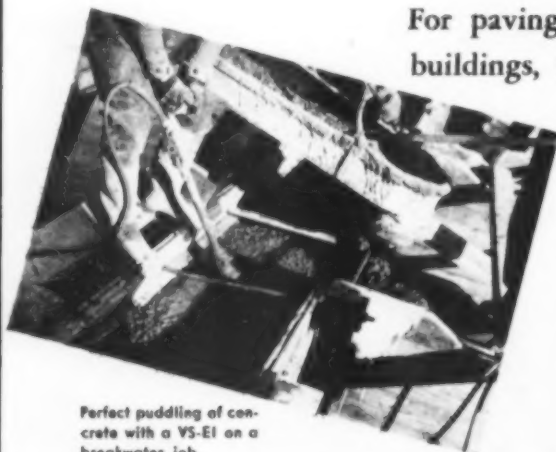
TOUGH shovels made from Nickel-molybdenum steel by the Ingersoll Steel & Disc division of Borg-Warner Corp., New Castle, Ind., must pass this bending test, pictured above, and spring back to their original shape. "Tem-Cross" rolling and heat treatment give a tensile strength of 240,000 pounds per sq. in.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

THE
JACKSON "VS-EI" VIBRO-SPADE
PLACES CONCRETE ON
ANY and ALL
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VS-EI With
SHORT RIGID HANDLE
Also With Handle Bent for Paving

VS-EI With
SHORT FLEXIBLE HANDLE
Also With 12' Flexible Handle



Perfect puddling of concrete with a VS-EI on a breakwater job.

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Saw Rigs — Pumps — Hoists
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12 SIZES
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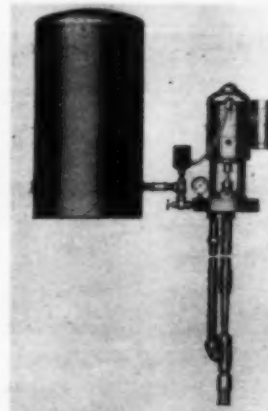
BAY CITY
SHOVELS
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Quality of workmanship, design accessibility, speed, working range and safe load capacity are built in features that assure BAY CITY owners more yardage at lower cost. For economical, efficient operation investigate BAY CITY Machines.

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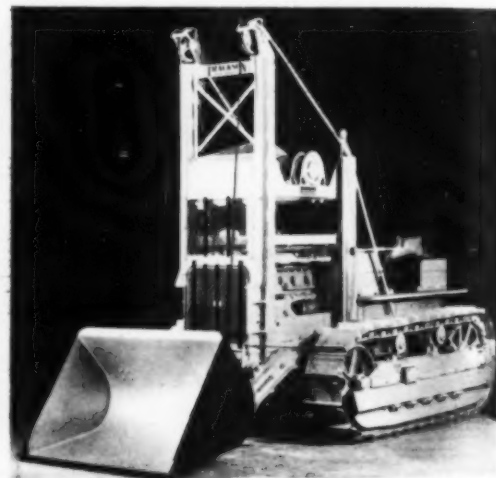
BAY CITY SHOVELS, INC.
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VERTICAL CENTRIFUGAL PUMP, close-coupled, motor driven, for general service in deep or shallow wells was designed to meet need for a small-diameter, low-capacity, dependable pump with low initial and operating costs. Pumps water under either high or low pressure at 6 to 60 g.p.m. Compact construction necessitates small space for installation, an important feature where floor space is limited. Said to be simple in design, quiet and dependable in operation; to require a minimum of attention and no lubrication. No mechanical moving parts below ground — no gears, belts, pulleys, rods, springs or valves to be replaced or repaired. Units for shallow well service (water lifts of 15 to 20 ft.) consist of motor, pump and base with single suction pipe extending below water level. Pumps for deep well (20 to 200 ft. deep) are equipped with an ejector and venturi in one or two drop pipes extending from pump into well — Fairbanks-Morse & Co., 900 S. Wabash Ave., Chicago, Ill.



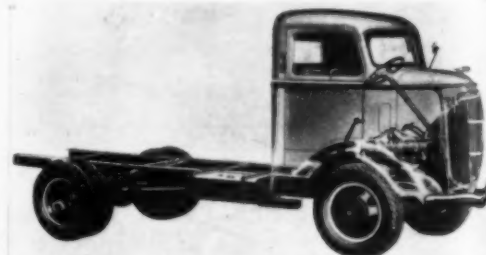
be replaced or repaired. Units for shallow well service (water lifts of 15 to 20 ft.) consist of motor, pump and base with single suction pipe extending below water level. Pumps for deep well (20 to 200 ft. deep) are equipped with an ejector and venturi in one or two drop pipes extending from pump into well — Fairbanks-Morse & Co., 900 S. Wabash Ave., Chicago, Ill.

HEAVY-DUTY DIGGER AND LOADER, available on Caterpillar tractors, excavates in clay, gumbo or rocky soil; does stripping, leveling and subgrading, charges conveyors, crushers and concrete mixers; removes snow, and transports or loads all kinds of



bulk materials. Trackson high-shovel equipped with 3/4-yd. bucket will dig, move and load up to 50 cu.yd. per hour. Advantages claimed: (1) fast mechanical hoist which is not affected by temperature; (2) independent front end drive; (3) free dumping of bucket at any point of lift; (4) automatic release when bucket reaches maximum height; (5) full visibility for driver. Caterpillar tractors for use with these machines are specially equipped with wide-gage extra length (live-roller type) rigid track frames, front power take-off and blower-type fan. — Trackson Co., Milwaukee, Wis.

CAB-OVER-ENGINE TRUCK LINE features usual cab-forward advantages of ideal weight distribution, greater load carrying space, shorter overall length, ease of handling in traffic and, in addition,



appearance, accessibility, driver comfort and safety. Presented in two capacity ranges, 12,000 to 15,000 lb., gross rating. Equipped with 228- and 268-cu.in. Reo Gold Crown engines. Four wheelbases offered in either series: 105 in. for close-coupled tractors, 125 in. for tractor and dump service, 147 in. for 12-ft. bodies and 166 in. for 15-ft. bodies. — Reo Motor Car Co., Lansing, Mich.

Significant Announcement

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- Continuous operation
- Ample crawler traction
- Automatic leveling without forms
- Ability to lay to grade
- Controlled spreading
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- Fool-proof thickness control
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- Operated from either side (dual controls)
- Variable width (8 to 12 feet)
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- Heated screed for ironing all materials, including hot sheet asphalt

38-5

I CONSIDER this one of the most important and significant announcements that Barber-Greene has ever had the privilege of making, as it may lead to new trends in bituminous road construction.

We have demonstrated the ability of our Finisher to lay sheet asphalt as well as all other bituminous materials.

Hereafter, our Finishers will be furnished with heating equipment that will enable the user to spread, level, tamp, and iron sheet asphalt to unbelievable perfection. Heat is absolutely necessary for laying hot, tacky materials, and is of tremendous advantage in handling all kinds of bituminous materials. The hot air heating system is simple and not very expensive.

Engineers have been working on the problem of mechanizing the spreading of sheet asphalts for almost fifty years, and we have been working on this particular type of machine for seven years. Those who have witnessed recent demonstrations claim that it is the answer, and I do not hesitate to recommend it for every type of bituminous material that has come to our attention.

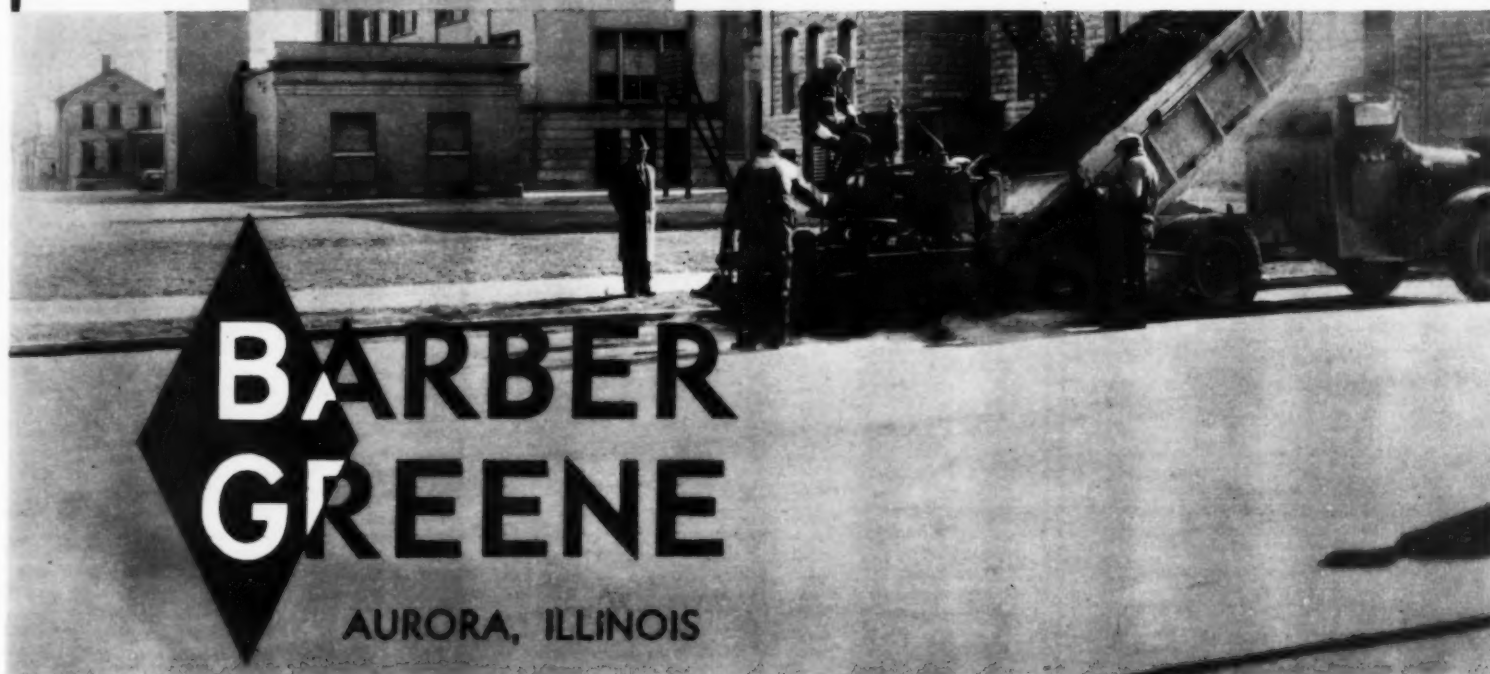
This is another Barber-Greene Machine that injects quality and lowers the cost of bituminous roads, or putting it another way . . . it permits the use of higher quality materials without greatly increasing the cost of the road.

Carefully study the significance of this announcement . . . also note the important new features embodied in our machine, and then write for further information.

We are in production, but current orders and shop capacity clearly indicate the importance of placing orders as soon as possible.

H. H. Barber

President Barber Greene Company.



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**WELL YOU SEE, BOSS—
THE PLANS SHOWED THE CANYON OVER THERE!**

Paper plans, like paper calculations, don't always tie in with the actual field facts. That's why engineers who know make sure of their cable tensions by checking them on the job with a Martin-Decker Cable Tension Indicator.

Simply clamp it to the line — no deadening and no wrenches required. It catches sudden impact loads or steady strains with equal efficiency!

Available in three sizes:

Miniature for lines and cables up to 3/16", capacity 200 lbs.

Standard for wires or cables from 1/4" to 3/4", capacity 15,000 lbs.

Heavy Duty for wires or cables from 3/4" to 2 1/4", capacity 260,000 lbs.

All sizes are adjustable for temperature changes.

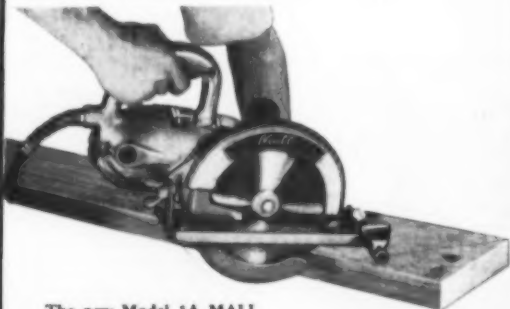
Write for full details on this instrument and also on the Martin-Decker Traveling Line Weight Indicator.



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**YOU HAVE NEVER
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until you have seen a MALL Electric Hand Saw rip through wood. It will cross cut a 3" x 12" board in four seconds and rip through a 2" plank 12' long in 35 seconds — easily, cleanly, and accurately. This is just about ten times faster than any man can do it with an ordinary handsaw.



The new Model 1A MALL
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MALL Electric Handsaws are saving hundreds of dollars for carpenters and builders on large and small contracts. It will pay you to investigate and learn what these saws can do for you.

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Other MALL products are concrete vibrators, and surfacers, flexible shaft machines, door mortisers and planes.

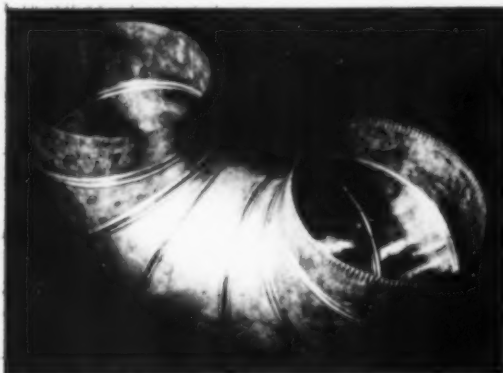
Without obligation, please send additional information on the Model 1A and other MALL Electric Handsaws.

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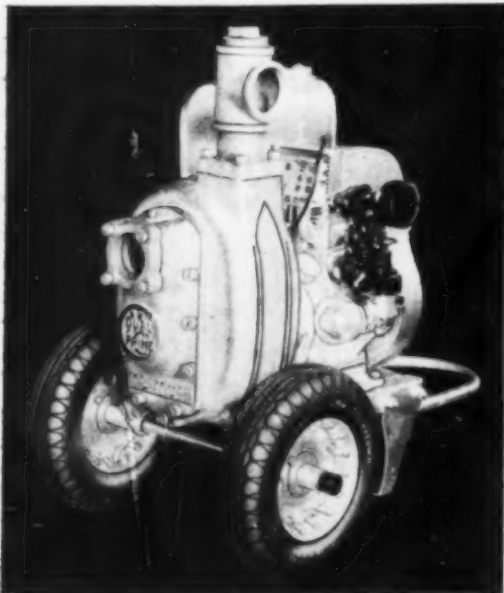
CITY STATE

GALVANIZED SHEETS AND COILS. 16 to 28 gage, called "Zincgrip," have heavy coating of commercially pure zinc that will not crack or peel when subjected to relatively severe drawing or forming



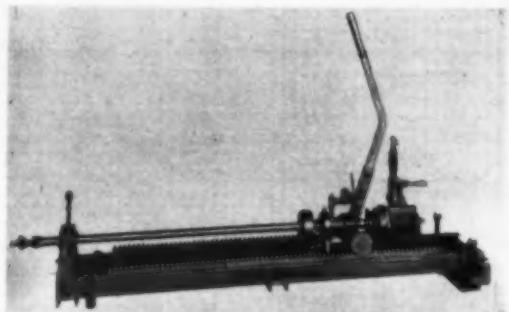
operations. Special use for new product: production of spiral corrugated lock-seam drainage pipe. Other uses: manufacture of roof drainage parts, shapes and stampings made by cold drawing and rolling processes, and also many kinds of fabricated products where resistance to corrosion is desirable. — American Rolling Mill Co., Middletown, Ohio.

DUAL-PRIME PUMPS, available in all standard sizes from 2 to 6 in., inclusive, are said to give contractor speed in operation and portability plus ruggedness to stand "gaff" of construction jobs. Dual priming



jets with simplified recirculation control and highly efficient impeller and volute assure maximum performance. Additional features: Three-blade trash-type impeller, "Perma-seal" flanged suction and discharge connections, adjustable impeller and close coupled construction. — Construction Machinery Co., Waterloo, Iowa.

BORING MACHINE, compressed air driven unit developed for faster boring of horizontal underground holes. According to company, bores can now be made in all diameters from 2 1/2 to 14 1/2 in. for dis-



tances of 175 ft. In several instances, Hydrauger users claim, cost of machine was saved on single pipe laying job, operations including boring through 60 ft. of solid granite and stringing a 12-in. main under an eight-lane super-highway. Said to simplify pipe-line extension particularly for coated or wrapped pipe. — Hydrauger Corp., 116 New Montgomery St., San Francisco, Calif.



**Quicker Cleaner
Lower Cost Pipe Cutting...
with this remarkable RIGID
Wheel-Blade Cutter**

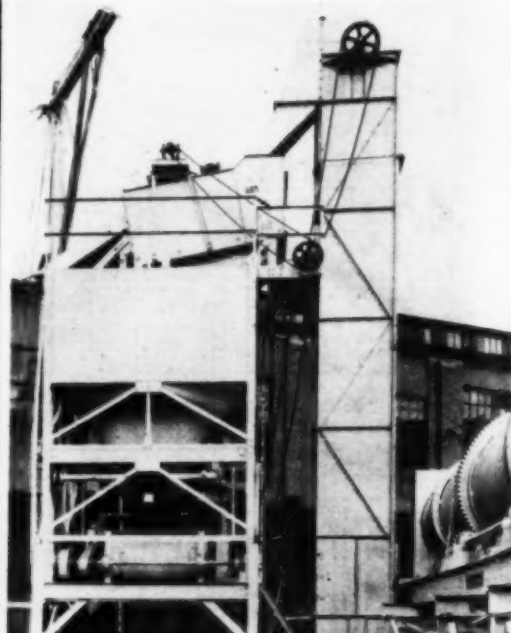
Because every RIGID tool is designed to save you bother and expense old fashioned tools cause you, the millions of them now in use have saved billions of hours that used to be wasted.

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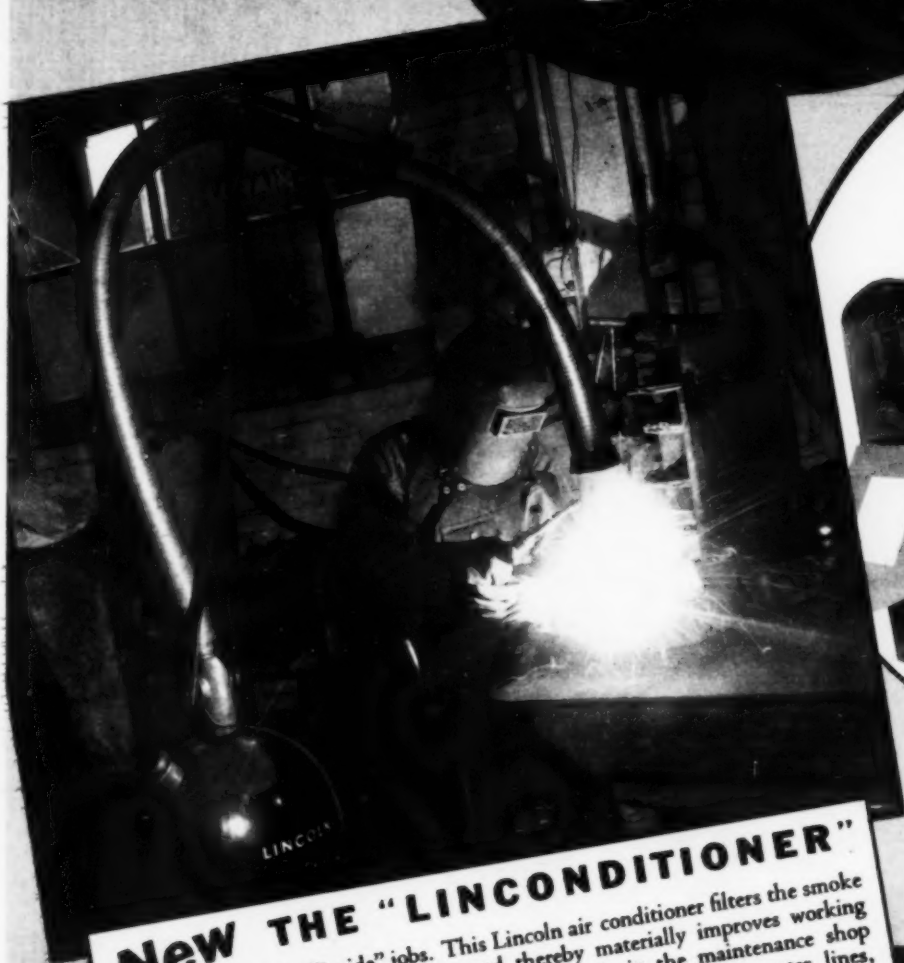
THE RIDGE TOOL CO., Elyria, Ohio

RIGID PIPE TOOLS



PORTABLE ASPHALT PLANT, of large capacity, is built in complete sectional units for transport by any standard hauling equipment. No capital investment tied up in tires and running gear. Four sizes have mixer capacities of 1,500, 2,000, 3,000 and 4,000 lb. Each plant is provided with its own erection equipment, including hinged steel mast with jib and hoist having power takeoff, thus reducing to minimum time of field assembly. Outstanding design features are: Steam-jacketed, steam-operated asphalt mixers; steam jacketed, bottom-discharge buckets; two, three or four-deck special inclosed vibrating screens; four-point suspension dial scales for weigh-box and asphalt cement bucket; two, three or four compartment steel bins with quick-acting cutoff gates; and hydraulic control, if desired, for operation of gates. Sectional units of plant are designed to comply with most highway loading and road clearance regulations. — Hetherington & Berner, Inc., 701-745 Kentucky Ave., Indianapolis, Ind.

LINCOLN brings you 3 IMPORTANT DEVELOPMENTS for lower costs



New THE "LINCONDITIONER"

For the "inside" jobs. This Lincoln air conditioner filters the smoke and removes the heat of welding and thereby materially improves working conditions for lower costs. Installation shown is in the maintenance shop of a large contractor. Other uses include work inside large water lines, siphons, caissons, tanks, etc. Mail the coupon today for your copy of Bul. 329.



New THE DIESEL "SHIELD-ARC"

A new simplified Diesel engine driven welder that cuts fuel costs 33% to 86%. Bul. 327-A tells all!

New

"FLEETWELD 8"

Users report 25% to 30% faster welding with this new Lincoln rod for fillet welds because it can be used in larger sizes for high quality production. See it in action.



MAIL THE COUPON
TODAY
FOR DETAILS ON
THESE COST-CUTTING
DEVELOPMENTS

LINCOLN

LARGEST MANUFACTURERS OF ARC WELDING EQUIPMENT IN THE WORLD

THE LINCOLN ELECTRIC CO.
Dept. G-498, Cleveland, Ohio.

- ☐ Send Bul. 329 on the "LINCONDITIONER."
- ☐ Send Bul. 327-A on the Diesel "Shield-Arc."
- ☐ I'm interested in "Fleetweld 8." Send Bul. 401.

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Company _____

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"Established 1885"

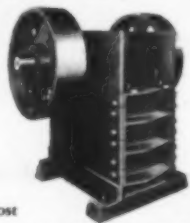
GRUENDLER Road Building — Equipment —

"One Reduction"
Roller Bearing
Jaw Crushers

Saves 10% to 15%
in Fuel
90% in Lubrication

More Production at Lower Cost

Mfrs. of Stationary or Portable Limestone Pulverizers, Gravel and Rock Crushing and Screening Plants, Conveying and Screening Equipment.



PORTABLE CRUSHING PLANTS

No Tipping on
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Swing
Hammer
Portable
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Ideal for
Farm to
Market
Road Work

Adjust-
able Crushing Range
from 2 1/4" down to Ag-
ricultural Dust.

Write for Illustrated
Bulletins of our Life-
time Hammer Mill and
Jaw Crushers.

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GRUENDLER CRUSHER & PULVERIZER COMPANY
Plant and Office: 2917 N. Market Street, St. Louis, Mo.

BAKER



Baker Bulldozer on Allis-Chalmers 50 Tractor leveling subsoil on the big Boat Basin Project on New York World's Fair site. — Alert Const'g. Co., Inc., Contractors.

BULLDOZERS

The wide acceptance of Baker Direct Lift Hydraulic Bulldozers and Gradebuilders among leading contractors is due to their simplicity, few wearing parts, great strength and accurate hydraulic control. There are combination moldboards which give you scores of new uses for your tractor. Economize with Bakers.

Ask for Bulletins on
Bulldozers and other
units of Baker Equipment.



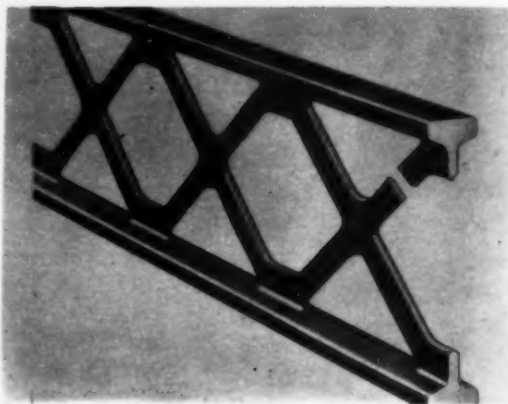
THE BAKER MFG. CO.
568 Stanford Avenue
SPRINGFIELD ILLINOIS



DETONATING FUSE called Primacord-Bickford consists of explosive core of Pentaerythritetranitrate (PETN) contained in waterproofed textile covering and has following characteristics, according to its makers: (1) Insensitive; (2) instantaneous; (3) increases efficiency of explosive charge; (4) economical; (5) light in weight, yet strong; (6) easy to handle, simple to hook up. Manufacturers claim there is no danger in handling or storage, that fuse cannot be set off by friction, fire or ordinary shock. Fabric covering said to afford greater flexibility with minimum weight, suitable tensile strength and excellent waterproof qualities. Photo shows workman loading Primacord into bore hole with primer cartridge of explosives attached. In this blast 148 holes were shot at one time with Primacord as detonating agent. — Ensign-Bickford Co., Simsbury, Conn.

STEEL REINFORCEMENT FOR CONCRETE.

known as Jaltruss, is an all hot rolled section made primarily for reinforcing concrete slabs in floors of bridges and other large structures in which floors are subjected to severe forces and stresses caused by heavy moving loads. Consists of simple steel section of double Warren truss design rolled into shape in one continuous operation on nine-stand tandem rolling mill. During process, especially selected structural steel of which section is made is well above critical rolling temperature and in a state of plastic flow. In construction of Neches River bridge, Port Arthur, Tex., described in May issue of **CONSTRUCTION Methods and Equipment**, 700 tons of Jaltruss are utilized for longitudinal and transverse reinforcement of bridge floor, as shown in photograph. — Jones & Laughlin Steel Corp., Pittsburgh, Pa.



LIGHTWEIGHT ROAD MARKER designed for marking black top as well as concrete roads with paint or hot asphalt is attached to motor car or truck and operated by driver. Said to provide clean, straight center line free from feather edge. Operates over even or uneven surfaced roads. Two continuous bands form outline for spray. All surplus paint is automatically brushed from marking.

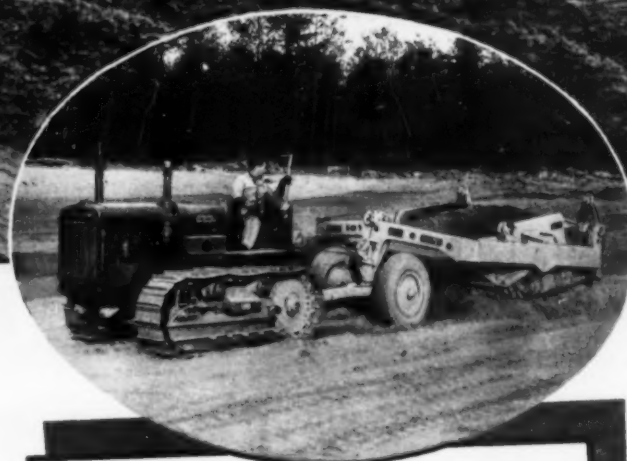


Stripe may be made narrower or wider by simple adjustment. In 15-min. time marking unit is set alongside of left rear wheel, guide is mounted on front bumper and driver is ready to operate equipment as car proceeds. Guide also may be swung to right to follow gutter line or edge of pavement. No air compressor needed, pressure being controlled by specially designed pump, operated by 1-hp. gasoline engine and equipped with bypass valve insuring complete agitation of paint at all times. Paint tank capacity, 60 gal. Said to mark 60 to 75 mi. of highway per day. — Meili-Blumberg Corp., New Holstein, Wis.

This McDonald Experience Proves INTERNATIONAL Efficiency



ABOVE: This gives an idea of the soft ground over which the six International TD-40 Diesel TracTracTors travel most of the time on this job. Two of the units are shown here working with a scraper and a bulldozer. AT RIGHT: Another Model TD-40 TracTracTor and scraper moving between 55 and 60 cubic yards an hour.



• Six International TD-40 Diesel TracTracTors are doing a large share of the excavating for the William P. McDonald Construction Company of Flushing, N. Y., on $4\frac{1}{2}$ miles of new highway near the eastern end of Long Island. Four of these Internationals are operating $4\frac{1}{2}$ -yard, 4-wheel scrapers on this job. The other two, one equipped with a bulldozer and the other with a bullgrader, are on grading work.

It was originally planned to let tractors and scrapers open up the work and then turn over the main excavation to other equipment. In a thorough five-day test, however, two International TD-40 Diesel TracTracTors proved so efficient on scraper work that the other four were purchased and the major part of the dirt moving given to them.

The facts and figures gathered by this nationally known construction company prove the value of International Diesel TracTracTors on the job. Our nearby International industrial power dealer or Company-owned branch can give you additional information on this model, and on other crawler and wheel tractors, and power units in the International line.

INTERNATIONAL HARVESTER COMPANY
(INCORPORATED)
180 North Michigan Avenue Chicago, Illinois

Five-Day Test on Internationals Your Guide to Efficient Power

★ One International Diesel TracTracTor moved 1,951½ cubic yards in 34.75 hours, averaging 56.2 yards per hour on an average haul of 524 feet. Average load was 4.11 yards and an average of 13.65 trips were made an hour.

★ The second unit, identical with the first, moved 2,061½ cubic yards in 34.25 hours, averaging 60.3 yards per hour on an average haul of 514 feet. Average load was 4.25 yards and an average of 14.15 trips were made an hour.

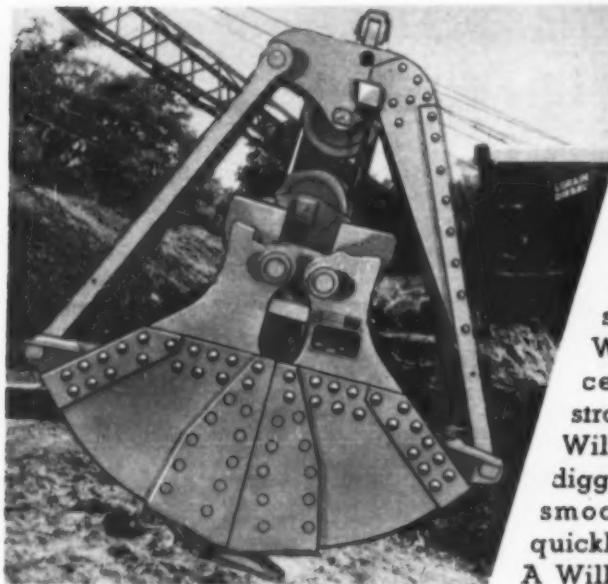
★ Their flexibility and travel speeds on scraper work, their correct balance and absence of unnecessary weight, the remarkable performance of the Diesel engine, and a minimum of "time-out" for maintenance won this job for TracTracTors.



Speed and Efficiency—two Internationals working side by side powering $4\frac{1}{2}$ -yard scrapers.

INTERNATIONAL Industrial Power

WILLIAMS *Buckets*



**Built to Last...
and
Move Dirt Fast!**

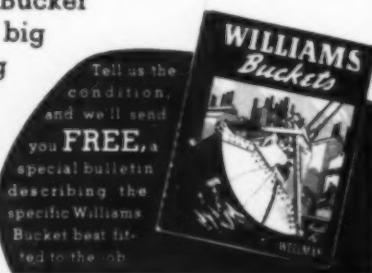
No "dead-head" metal rides in Williams Buckets—you swing pay loads, not inert metal! The special welded construction of Williams Buckets eliminates excess weight—makes them stronger, and more enduring. Williams Buckets are powerful diggers. They bite full loads smoothly and easily, open quickly and dump cleanly.

A Williams Bucket can play a big part in making excavating or material handling more profitable.

The Williams Line includes Power-Arm, Multiple Rope, Power Wheel, Single Line Hook-on and Dragline Bucket.

Distributors located in all parts of the country are competent to render valuable field service.

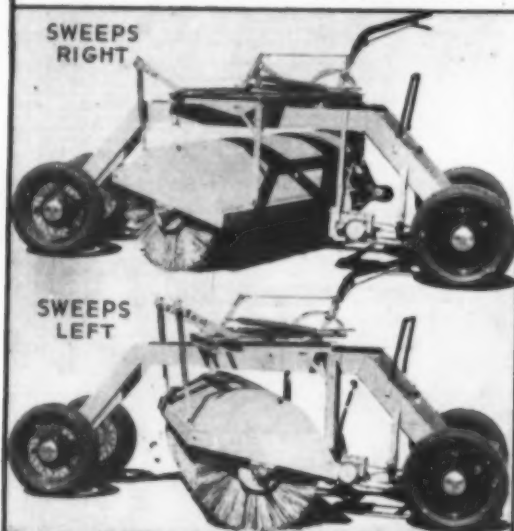
THE WELLMAN ENGINEERING COMPANY
7000 CENTRAL AVENUE CLEVELAND, OHIO



Tell us the condition, and we'll send you **FREE**, a special bulletin describing the specific Williams Bucket best fitted to the job.

built by WELLMAN...

3 SPEED REVERSIBLE TRACTION BROOM



Every bearing is a Ball or Roller. The oil tight transmission case gives instant change of broom revolution or heavy brooming. No engine to wear out.

Fully Guaranteed

SPEARS-WELLS MACHINERY CO.
1832 W. 9th St., Oakland, Calif.

TRANSIT

PIONEER OF TRUCK MIXERS



have 5 basic features OF SUPERIORITY

Two kinds of superiority—(1) of concrete mixing and (2) of design and construction to avoid breakdowns and repairs on the mixer itself. Here they are:

- (1) Mixing blades designed strictly for 100% MIXING.
- (2) Water injected under pressure, FAST.
- (3) Drum proportions permit ideal weight distribution on truck.
- (4) Low center of gravity.
- (5) A mixer frame not affected by any chassis strains or distortions.

**SEND
FOR THE
TRANSIT
CATALOG**

NOW...GET COMPLETE DESCRIPTION of the new Transit Truck Mixers and discover how you can get better concrete and make more profits on your job—large or small.

TRANSIT MIXERS, Inc.
75 West St., New York City, N. Y., U. S. A.

News from Manufacturers

ABOUT THEIR PRODUCTS

The publications, reviewed below, will keep you posted on latest developments in construction equipment and materials available for your use.

ALL-PURPOSE EXCAVATOR — Universal Power Shovel Corp. 1903 South 62nd St., Milwaukee, Wis. (8-pp. folder, illustrated.) Descriptions of Units 614 and 616 of 1/2- and 3/4-cu.yd. capacity, respectively, convertible from power shovels to cranes, draglines or trench hoes. Drums mounted on individual short shafts supported on ball bearings—no bushings to lubricate or replace. All reverse motions accomplished through spur gears, eliminating end thrust. All gears, are inclosed and run in oil bath. Crawler adjustment by single screw. Five operating clutches are of disk type and are interchangeable. Folders contain detailed specifications and illustrations of various improved mechanical features.

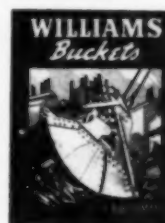
SOIL STABILIZATION WITH TAR — The Barrett Co. 40 Rector St., New York, N. Y. (10 pp., illustrated.) Explanation of application of Tarvia as binder and as waterproofing agent.

Preliminary investigations should cover depth of stabilized foundation, amount of aggregate to be added, grade and amount of tar, optimum moisture content. Sequence of construction operations is suggested, with illustrations of recommended types of equipment. Hints on machine mixing.



PORTABLE ELECTRIC TOOLS — Independent Pneumatic Tool Co. 600 West Jackson Boulevard, Chicago, Ill. (48 pp., illustrated.) Covers Thor line of electric drills and reamers in sizes from 3/16 to 1 1/4 in. for light and heavy-duty service, electric hammers (convertible into drills, electric saws for 6-12-in. circular blades, screw drivers and nut setters, tappers, grinders, sanders and polishers, with accessories. Electric heat gun for thawing frozen grease in engine parts. Mechanical features of portable electric tools include triple-insulated, hand-wound armatures, special built-in commutators, extra long carbon brushes to assure long life, ball-bearings, alloy steel gears. A slow-speed drill is designed for cutting through stainless steel. Weights for different types and sizes range from 2 1/2 to 49 1/2 lb.

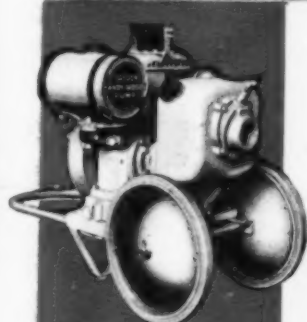
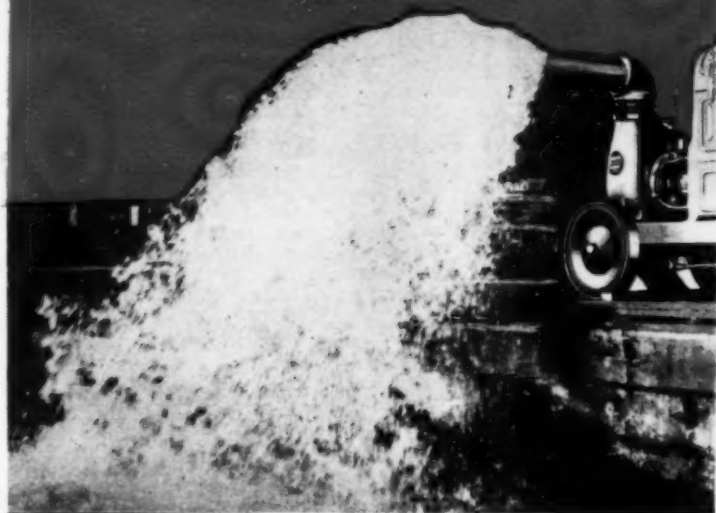
BUCKETS — Wellman Engineering Co. 7000 Central Ave., Cleveland, Ohio (40 pp., illustrated.) Size range from 3/4 to 12 cu.yd. for Williams (merged with Wellman in 1931) clamshell



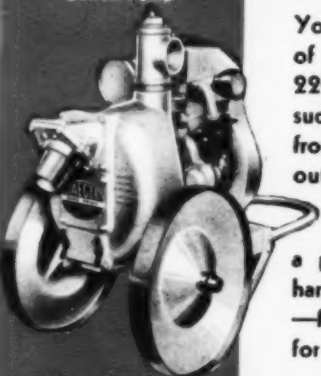
and dragline buckets. Types include general purpose, excavating, dredging, cleanup and rehandling, heavy duty, and industrial handling. Design features include straight-line reeving, tandem sheave for greater power and longer cable life, power-arm lever combined with block and tackle and rigid A-frame construction. Multiple-rope type buckets in several sizes. Detailed specifications, weights and dimensions for each size of bucket. Dredging buckets are of alloy steel, welded construction.

AIR-COOLED ENGINES — Wisconsin Motor Corp. Milwaukee, Wis. (4-pp. folder, illustrated.) Positive cooling of heavy-duty 4-cylinder, 4-cycle engines, developing from 16 to 28 hp., is obtained from large fan cast in flywheel which forces strong blast of air across and around cylinders and heads. Radiators, water-pumps, fans and fan belts eliminated. All parts automatically lubricated—no grease cups. Where weight is a factor engine parts can be supplied in cast aluminum, resulting in engine weight of only 34 lb.

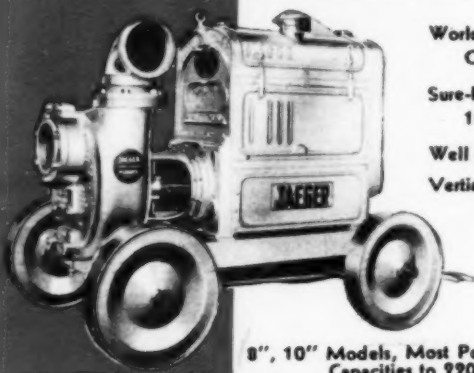
Water Meets Its Master When You Use a JAEGER PUMP



Jaeger "Handy"—Lowest Priced 7000 Gallon Pump



Compact 2", 3", 4", 6" Models—10,000 to 90,000 G. P. H.



8", 10" Models, Most Portable of Big Pumps—Capacities to 220,000 G. P. H.

Faster Priming + High Efficiency + Longer Service = LOWEST COST per GALLON

Contractors put more faith and money into Jaeger Sure Prime Pumps than any other make. They'll tell you it's because no other pump KNOWS HOW TO HANDLE WATER like a Jaeger.

You can prime and pump a tiny trickle of air and water or a roaring flood of 220,000 gallons an hour. You can suck dry the wettest sand, lift water from the deepest hole, jet it or force it out through miles of pipe. On any job where water is a problem, give it to a Jaeger Sure Prime. You'll have a pump that will prime faster, pump harder, work thousands of hours longer—for less money than you've ever paid for pumping.

THE JAEGER MACHINE CO.
800 Dublin Ave. Columbus, Ohio

World's Largest Manufacturer of Contractors' Pumps

Sure-Prime Centrifugals—2" to 10" Sizes, Gas, Electric

Well Point Systems

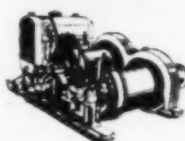
Vertical Caisson Pumps

Dual Duty Jetting—

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Diaphragm Pumps,

Triplex Road Pumps



HOISTS
from 10 to 100 H. P.



MIXERS
Tilting, Non-Tilt, 3 1/2 to 56 Sizes



Ahead on All Three!



- **CAPACITY** (Lays Material Faster than Most Plants Can Mix It)
- **ADAPTABILITY** (Lays Stone, Macadam, Hot or Cold Mixes—Widths to 14 Ft.)
- **SMOOTHNESS** (Equivalent to Form Job)

Capacity exceeds 100 tons an hour on many jobs. Long equalizing runners act as movable forms. Weight and traction are confined to hard subgrade. Lays wide widths, blends joints, paves flush to curb or header—cuts costs, does better job. Send for Catalog.

THE JAEGER MACHINE CO., 800 Dublin Ave., Columbus, Ohio
World's Largest Builder of Spreading and Finishing Machines

JAEGER *Bituminous* PAVER



SPEED KING

JAEGER'S 10S BRIDGE BUILDER

fastest selling, fastest performing mixer—on the road, on the job!

Trails at 35 m.p.h. on two pneumatic tires, Timken bearings—loads and discharges faster, even with stiffest concrete—and discharge cuts cost of placement in the forms. Also built in 75 size. Get new Catalog and prices.

The JAEGER MACHINE Co.
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OTHER SIZES TYPES
3 1/2 to 56S



COMFORTABLE *Dust* PROTECTION FOR THE CONSTRUCTION WORKER

(U. S. BUREAU OF MINES APPROVED)

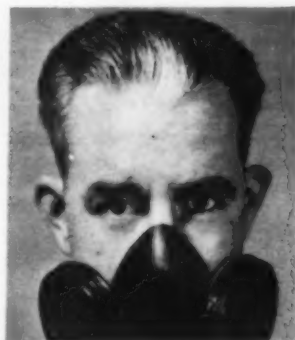


THE *Dustfoe* RESPIRATOR

Aluminum and rubber in construction, the new Dustfoe Respirator weighs only 3 1/4 oz.—so light it can be worn with comfort throughout the working shift. Does not hinder natural breathing. All parts are interchangeable, quickly replaceable, and may be thoroughly sterilized. Full vision in every direction, no interference with goggles or head covering. Investigate Dustfoe's many advantages to you,—write for Bulletin CM-CM-1!

THE M·S·A Comfo RESPIRATOR

The rugged, lightweight M.S.A. Comfo has a long record of popular service in the construction industry. Oversize twin filters with remarkably low breathing resistance filter even the harmful invisible dust particles from indrawn air—are low in cost, long lasting and quickly replaceable. Two types available, for pneumoconiosis producing dusts and chromic-acid mists, and lead dust. Send for complete details.



MINE SAFETY

Braddock, Thomas & Meade Sts., Pittsburgh, Pa.



APPLIANCES CO.

District Representatives in Principal Cities

A "JACK OF ALL TRADES" OLD STUFF, YOU SAY? LISTEN TO THIS!

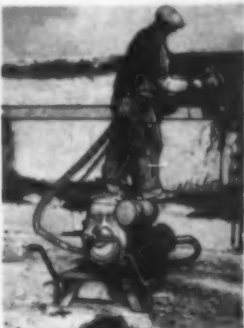
ONE MALL power unit will VIBRATE concrete and SURFACE the concrete after the forms are stripped. You can use it, too, for DRILLING, PUMPING, GRINDING, or SAWING. How? By simply attaching the required tool for each application.

These versatile tools will earn big dividends on your next job.

We'll gladly send bulletins.



MALL vibrator with gas engine power unit.



The same power unit used for concrete surfacing.

MALL TOOL COMPANY

7757 South Chicago Avenue, Chicago, Illinois

Without obligation, please send additional information on MALL Concrete Vibrating and Surfacing Machines.

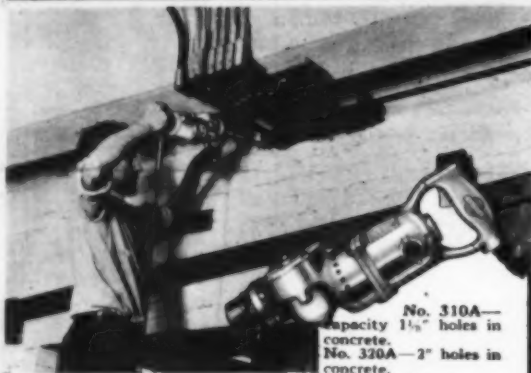
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YOU CAN EXPECT MORE FROM A STANLEY ELECTRIC TOOL



No. 310A—capacity 1 1/2" holes in concrete.
No. 320A—2" holes in concrete.

ONLY A STANLEY ELECTRIC HAMMER HAS THE FREE-THROWN PLUNGER

Improved and exclusive construction of a Stanley Electric Hammer delivers the full power of every blow without shock to motor, gears, housing or operator. You are assured of more work and more hours of work with these powerful tools.

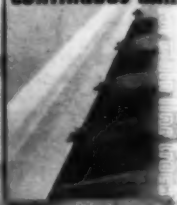
Use them for drilling, chipping and channelling concrete, stone or brick. Vibrating concrete forms. Tamping concrete. Scaling off rust and paint. Operate on AC or DC current—no converters or control boxes needed. Ask for a demonstration or write for descriptive literature. Stanley Electric Tool Division, The Stanley Works, New Britain, Conn.

STANLEY ELECTRIC HAMMERS

"COST LESS PER YEAR"

CONTINUOUS RAIL—Metal & Thermit Corp., 120 Broadway, New York, N. Y. (30 pp., illustrated.) Advantages of welded railway track in lowering joint maintenance costs, producing smooth-riding qualities and prolonging life of rail. Examples of welding for railroad rails in this country and abroad. Rail creepage eliminated. Details of Thermit welding process are described and illustrated.

CONTINUOUS RAIL



VIBRATION CONTROL—Korlund Co., Inc., 48-15 32nd Place, Long Island City, N. Y. (12-pp. pamphlet, illustrated.) Explains methods of protection against transmission of machine vibrations and laws governing their control. Isolating materials discussed include cork in plates and in unit housing devices, steel springs, their functions and applications to machines with and without concrete foundations.

CARE OF RUBBER HOSE—Raybestos-Manhattan, Inc., Passaic, N. J. (Card for hanging on wall.) Instructions to insure proper maintenance and long life for hose cover such points as proper selection for service, unpacking, bending or crushing, pressure, support, storage. Hints on attaching couplings.

EARTH MOVING EQUIPMENT—R. G. LeTourneau, Inc., Peoria, Ill. (8-pp. folder, illustrated.) Variety of cost cutting jobs being done by carryall scrapers, bulldozers, snow plows and tractor cranes owned by counties and government organizations.

PIPE PROTECTION—The Barrett Co., 40 Rector St., New York, N. Y. (36 pp., illustrated.) Coal-tar pitch base enamel for extending useful life of steel and



cast-iron water mains by preventing tuberculation and insuring low frictional resistance. Enamel lining applied by centrifugal spinning of pipe. Profusely illustrated with installation photographs. Company will submit, on request, technical specifications for materials and for their application.

ROAD MAINTAINER—Allen Machinery Corp., First National Bank Building, Shreveport, La. (12 pp., illustrated.) Blade frame, carrying replaceable skid shoes, is constructed of angles and I-beams, electrically welded. Two blades are of abrasive-resisting steel arranged so that they may be turned end for end and are interchangeable to front or rear position. Maintainer is pulled by 3-5-ton truck or 15-30-hp. tractor at speeds of 8 to 12 mi. per hour. Frame is mounted on four balloon-type pneumatic tires. Attachments include scarifier and stone thrower. Controls are hydraulic, with seamless tubing used for piping. Automatic blade regulating feature is actuated by amount of drawbar pull, raising blade when excess material is encountered.

FIBRE CONDUIT—Fibre Conduit Co., Orangeburg, N. Y. (26 pp., illustrated.) New fibre conduit for cable protection, called Nocrete, is designed for installation underground without concrete incasement. Advantages claimed are economy, mechanical strength and durability. Tubes are made of coal-tar pitch and felted fibres and are non-permeable at relatively high hydrostatic pressures. Sizes from 1 1/2- to 4 1/2-in. diameters and weights from 1.4 to 5.1 lb. per linear foot. Standard lengths 8 ft.—5 ft. in some sizes. Also details of Orangeburg standard conduit for use with concrete envelope.

CHAIN LINK FENCE—Wickwire Spencer Steel Co., 41 East 42nd St., New York, N. Y. (44 pp., illustrated.) Construction and specification details of various types of fence for industrial, residential and institutional service. Fabric is woven in diagonal mesh of copper-bearing, hot-galvanized steel wire. Gate framework is of hot-galvanized tubular steel, with fittings of malleable iron or pressed steel. Posts of H or I sections. Fencing types include road guard, 24 in. in width. Instructions for proper installation are accompanied by detailed sketches.



NOVO NEWS REEL

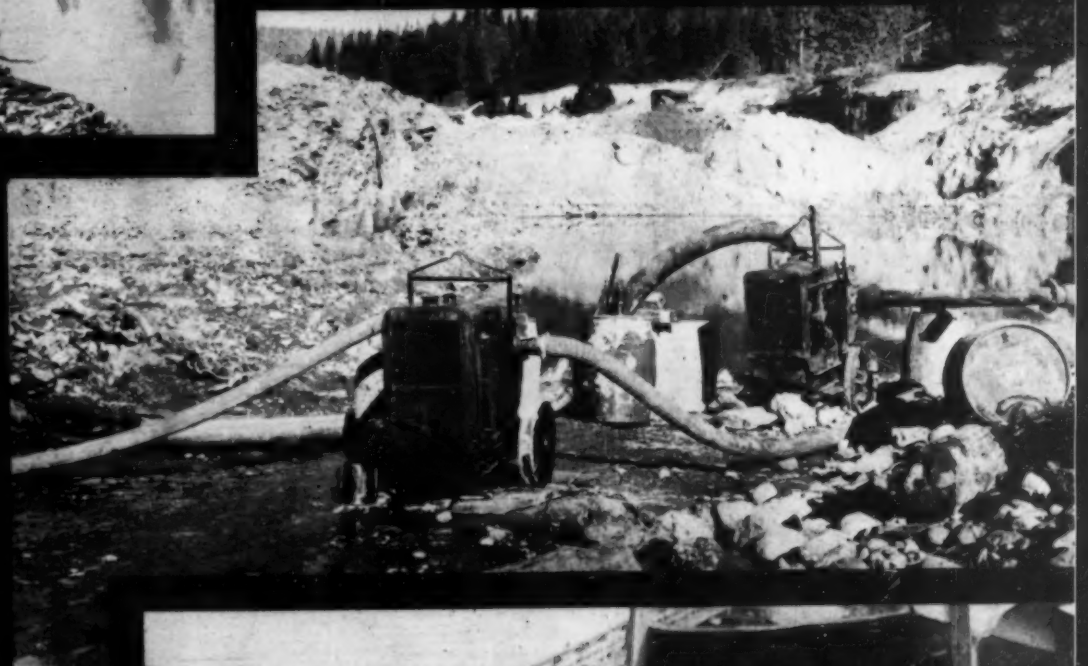


Water? You have to have it for gravel washing. Here the Novo 4" Self-Primer is furnishing water for the washing plant in the background. Look at the head against which that pump is working — from suction to discharge at the top of the plant.
Consolidated Construction Co.
Birdville, Texas



(Left) Lake formed on the operations of the Shovel Placer Mining Co. of northern California. Severe storms caused their excavation to become completely filled. (In the circle) are shown two Novo Pumps that were used to de-water this large area. These Pumps saved a great loss by preventing caving of the tailing piles around the hole.
(Below) A close up of the 3" and 6" Novo Self-Primers shown in the circle at the left. — The Pumps that saved the gold — They will save money on any job.

(Below Right) The Licking Gravel Co. of Newark, Ohio, are "licking" their gravel handling problems with this Novo Dragline Hoist powered with a 40 H.P. electric motor. They are taking out 400 Cu. Yd. per day. The news behind this news is — Hoist is multiple steel roller chain drive. The double cone friction blocks are of asbestos composition, giving a double friction area of highly efficient, long-lived material.
Send for complete information on Novo Self-Priming, Centrifugal, Diaphragm, Pressure, and Road Pumps. Also any type and size of Builders and Dragline Hoists.



NOVO ENGINE CO.

214 Porter St. Lansing, Mich.

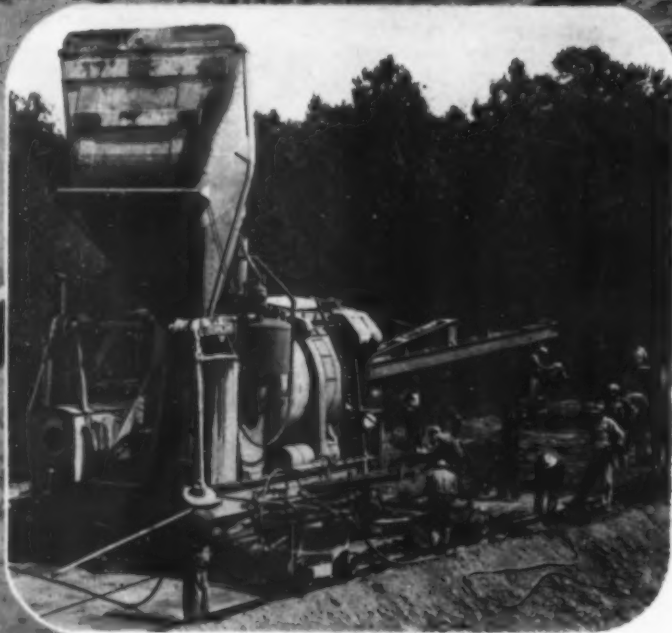


KOEHRING



HIGH SPEED PRODUCTION

When high speed production is required, Koehring Autocycle Pavers always meet the demand. They produce high quality concrete — autocycle operation assures "no-delay" production — stability and Heavy Duty construction permit equally efficient pouring from shoulder or subgrade. Koehring Pavers help to maintain the "profit" schedule.



For the super high speed job, the 34-E Twinbatch Paver increases production from 75% to 90% over the single drum 27-E Paver. Koehring Twinbatch Pavers owned by leading contractors are establishing high yardage records.

KOEHRING COMPANY
CONSTRUCTION EQUIPMENT • MILWAUKEE, WISCONSIN

ON THE SIXTH HIGHEST BRIDGE

in the
U.S.A.

**REX 160
PUMPCRETE**

saved up to
\$1.50

PER YARD



View showing Beaumont Construction Company's barge which carries the Rex 160 Pumpcrete. Red lines show 160's pipeline extending from barge to the forms.

HOW
DO YOU PLACE
CONCRETE
ON YOUR
SMALL JOBS?

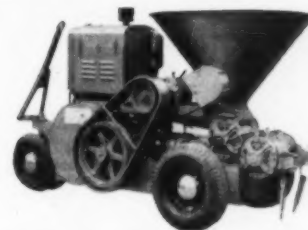
"IT MADE HANDLING CONCRETE A PLEASURE"

Besides showing a net saving of almost \$1.50 per yd. by using the Rex 160 Pumpcrete to pump 6500 yds. of concrete on their Port Arthur bridge job, the Beaumont Construction Company of Texas has this to report:

"The Pumpcrete lived up to each and every thing we were told it would do; and we are pleased to state that the Pumpcrete has not only saved us many dollars, but has also expedited our work and made handling concrete a pleasure . . . the Beaumont Construction Company recommends it."

Here the portable 160 Pumpcrete proves its adaptability for still another type of concrete placement work. It can make big savings for you on your small underpasses, overpasses, viaducts, bridges, sewage plants, culverts, warehouses, etc. Estimate the cost of doing your job with the 160 before you place your next bid—see for yourself why it is fast becoming the country's leading concrete placement machine.

CHAIN BELT COMPANY OF MILWAUKEE



SEE WHAT THIS PORTABLE CONCRETE PUMP WILL DO FOR YOU!

Send for the new book "Presenting the Rex 160 Pumpcrete." It answers all your questions about this new machine with facts and figures—shows exactly what it has done on many types of construction work. Send for it today. Use the handy coupon below.

CHAIN BELT COMPANY
1664 W. Bruce St., Milwaukee, Wis.
Please send me my copy of "Presenting the Rex 160 Pumpcrete." I'm interested in buying ☐ renting ☐ a Rex 160 (check which).

Name
Street No.
City State
Co.'s Name
Position in Co.

REX

PROCESS—GIESE • SYSTEM—KOOYMAN

PUMPCRETE

It has

FOR 3/4 YD. WORK

• One good look at this fast, reliable shovel of full 3/4 yard capacity will prove its extra advantages to you. A quick glimpse at its specifications will capture your interest.

Why? Because Byers 83 has *everything* for 3/4 yard work.

It was designed originally as a full 3/4 yard from dipper to crawlers. It is built to stand up for 3/4 yard jobs.

Model 83 is *not* a 1/2 yard "stretched" up to 3/4 yard. It is *not* a 5/8 yard "stretched" up to 3/4 yard. Such dangerous practices could never have resulted in a shovel as rugged, dependable, and well balanced as Byers 83.

Not a single part was ever used on 1/2 yard or 5/8 yard sizes and then borrowed for service on this model.

General construction of all rolled steel, formed under dies, and reinforced to provide maximum strength, eliminates every pound of excess weight. More than enough power...and the right *kind* of power...is available for tough digging. Line speeds, swing speed, and travel speeds are fast to produce extra yardage.

You should get the new illustrated catalog and complete specifications for a close inspection of Byers 83. See for yourself how sturdily and simply it is built. Investigate what it can do for you. Why not inquire today? Use the handy coupon.

THE BYERS MACHINE COMPANY • RAVENNA, OHIO

Distributors throughout the World

Send me, without obligation, new illustrated catalog and complete specifications of your 36,000 lb. full 3/4 yd. shovel, Model 83.

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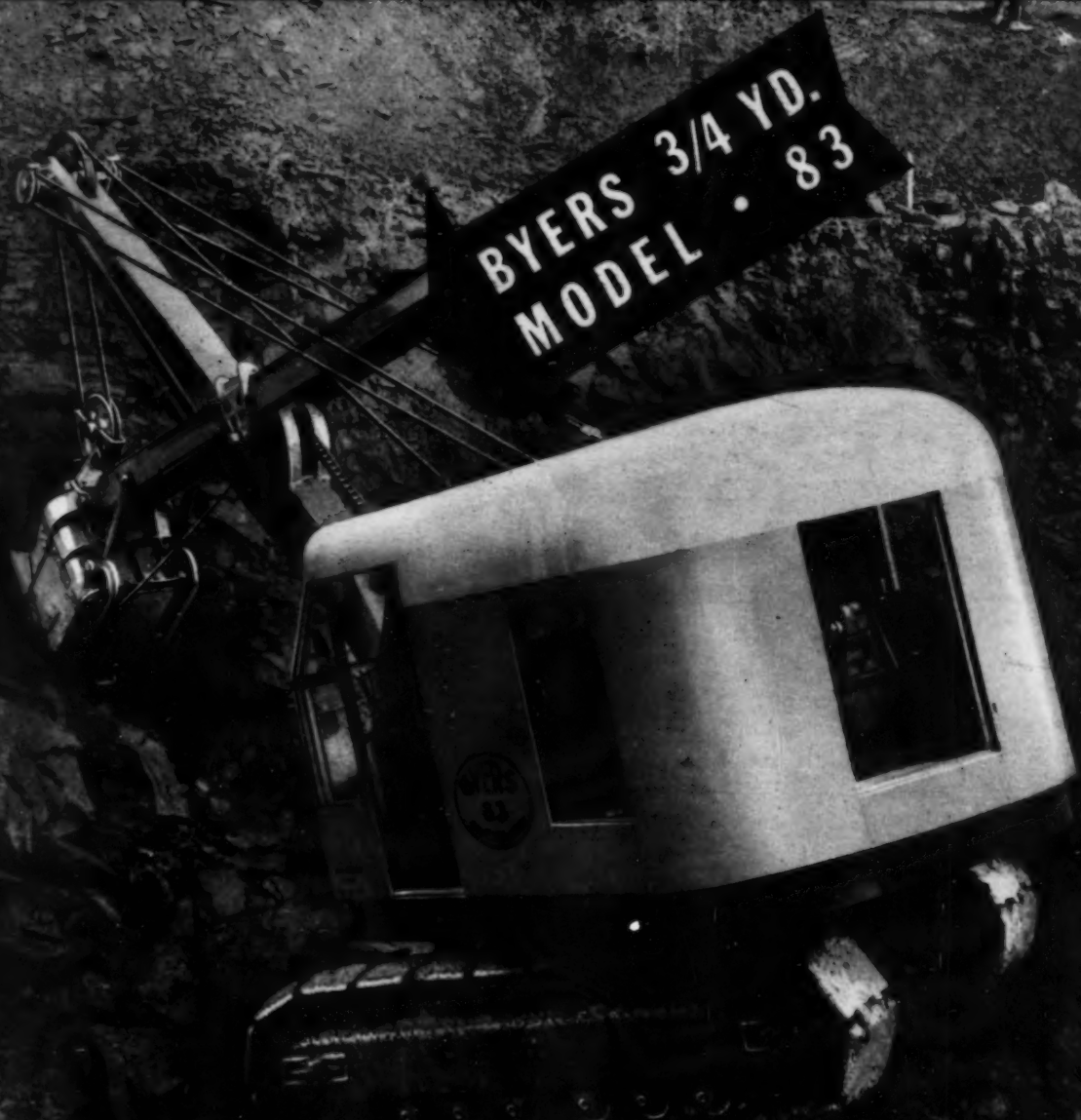
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SIGN • TEAR OUT • MAIL
HELP YOURSELF DO
FASTER, LOWER COST
DIRT MOVING THIS YEAR

FAST • POWERFUL BYERS

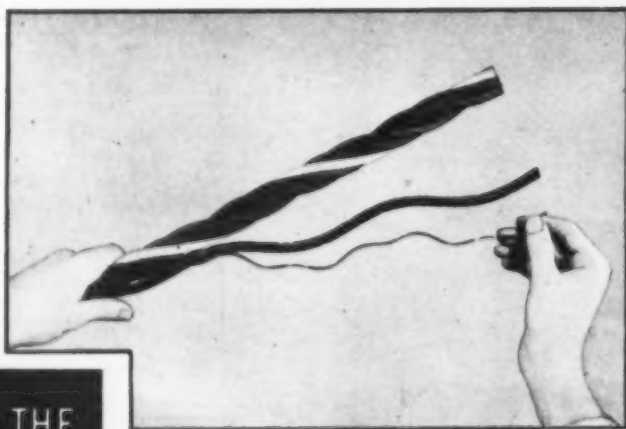
Everything



36,000 LB." 83"
3/4 YD.

WHEN YOU SEE HOW IT'S MADE YOU UNDERSTAND WHY
**MACWHYTE PREformed GIVES
 BETTER SERVICE!**

∴ SAYS HARRY PARKER, MACWHYTE SPECIALIST ON PREFORMING



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Whyte Strand
 MACWHYTE
 WHYTE STRAND
 IS BETTER
 BECAUSE IT'S MADE
 BY SPECIALISTS

**MACWHYTE
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Manufacturers of wire rope
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Distributors and stock
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 for quick service.

NO. 337-A

● Notice how each wire and each strand in this rope is shaped. They're curved that way for a very definite reason. Let Harry explain . . .

"The PREforming process shapes every wire to the exact curvature it takes in the finished rope. Instead of being held together under tension like in ordinary rope, the wires in PREformed lie relaxed. There's no internal stress.

MACWHYTE PREFORMED WEARS LONGER

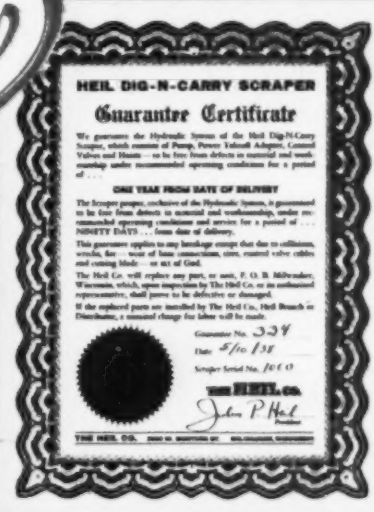
"When you get rid of these internal stresses—as we do in Whyte Strand PREformed—you lengthen the fatigue life of the rope and get longer, better service."

For jobs where ropes must stand up under severe bending, high speed and continuous operation, Whyte Strand PREformed outwears ordinary rope.

This is a tribute not only to the expert workmanship and modern methods of manufacture found in the Macwhyte plant, but also to the Macwhyte laboratory. For it is the laboratory—always looking ahead—which has done most to make Macwhyte Whyte Strand PREformed the best wire rope money can buy.

MACWHYTE
Whyte Strand - PREformed
 THE WIRE ROPE WITH THE INTERNAL LUBRICATION

The HEIL DIG-N-CARRY has a GUARANTEED Hydraulic System



Heil Dig-N-Carry in
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"Level-Loading" position

THE HEIL CO.

HILLSIDE, NEW JERSEY
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The hydraulic system that operates the efficient Heil Dig-N-Carry scraper incorporates the same efficient Heil hoisting mechanisms used in world famous Heil hydraulic dump units—Here are the outstanding advantages of the Heil Dig-N-Carry hydraulic system: (1) Positive, hydraulic power raises and lowers bowl—raises and lowers from apron—moves unloading apron forward and back; (2) No cables, cams or sheaves to break or get out of order; (3) Full tractor hitch and un hitch—Guaranteed hydraulic operation is only ONE of MANY Heil Dig-N-Carry features—NOW is the time to investigate—Use the attached coupon!

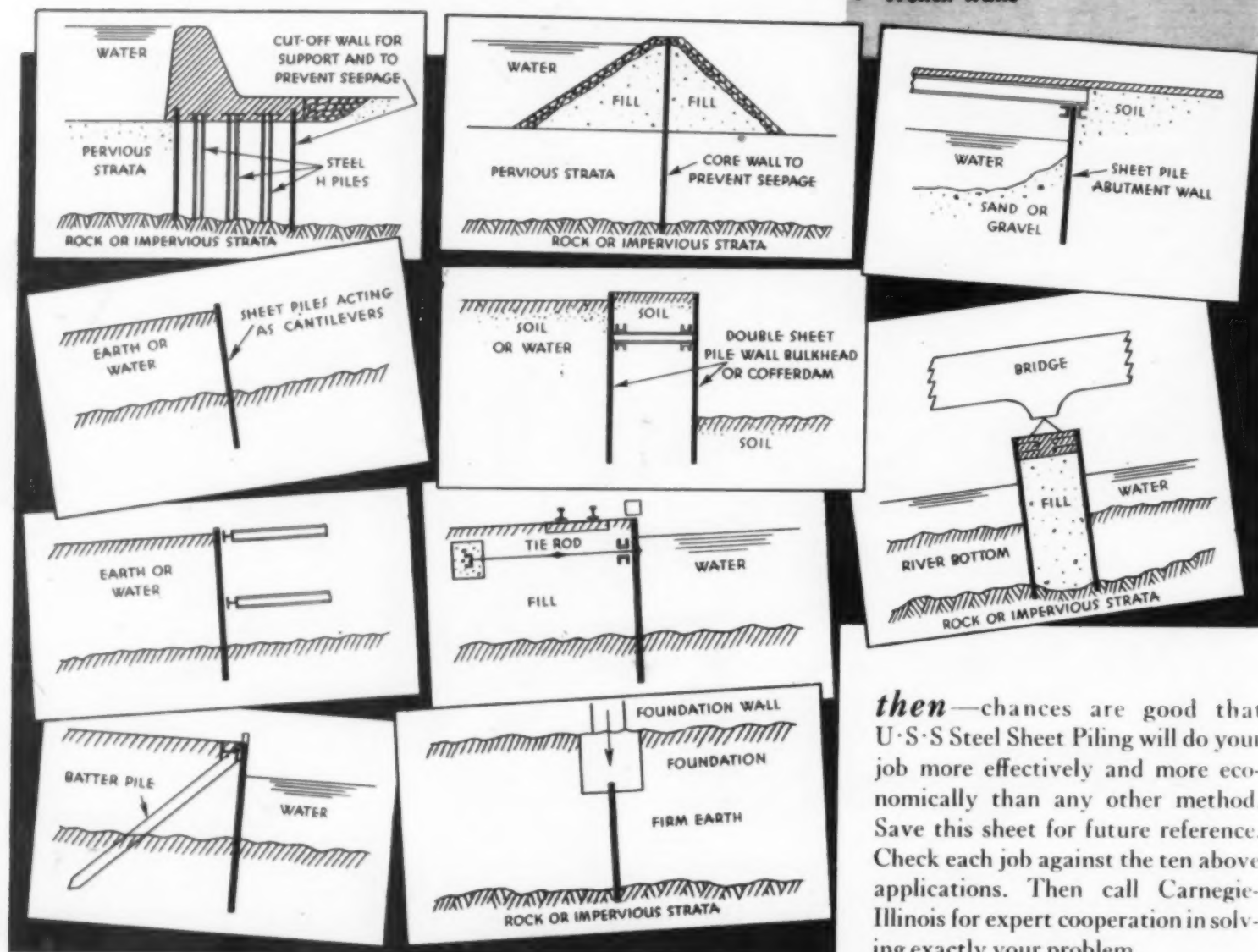
THE HEIL CO., 3000 W. Montana Street, Milwaukee, Wis.
OK Heil send complete facts about Heil Dig-N-Carry Scrapers to:

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IF you are designing structures like these—

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then—chances are good that U·S·S Steel Sheet Piling will do your job more effectively and more economically than any other method. Save this sheet for future reference. Check each job against the ten above applications. Then call Carnegie-Illinois for expert cooperation in solving exactly your problem.

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UNITED STATES STEEL



"SOUP"

DEEP, swirling "soup" that washes completely over the top of the blade—but it's "duck soup" for the Bucyrus-Erie Bullgrader on this South Dakota road job at Custer National Park! Whether it is working in thick, sticky mud like this, or in rocks, brush, sand or hard-packed material, the ruggedly-mounted, hydraulically-powered Bullgrader can be counted on to make maximum use of the tractor's power and maneuverability for dependable, high-speed, pay-load performance on every job. For new economies in dirt-moving, investigate Bucyrus-Erie's complete, modern line of tractor equipment.

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**..and what
can we do for you?**

OUR FULL NAME IS

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— but it doesn't begin to represent the complete range and nature of our business. So — in answer to many queries from engineers and construction men we give below an abridged catalog of our line for concrete construction.

Tyscrus, Tyloops, Tilt Lock Clamps, Anchors, Bolts, Snap-Tys, Rod Clamps, Rod Tighteners, Rod Pullers, Band Clamps, Cone and Hex Nuts, Column Clamps, Ty-hangers, Beam Clamps, Beam Saddles, Soffit Spacers, Accessories for Reinforcing Steel, Sleeper Anchors, Reed Clips, Shores and Splicing Clamps for Timbers.

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Tying Devices for Concrete

241-251 BUSH STREET
BROOKLYN, NEW YORK



PLUM CREEK SIPHON—NEBRASKA

(Inland Const. Co., Omaha—Contractors)

The contractor had to build this big Power and Irrigation Siphon beneath a river — and he didn't want wet feet. A 100% MORETRENCH WELLPOINT SYSTEM looked like good insurance — and it was.

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MORETRENCH CORPORATION**

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**MORE LIGHT
FOR
LESS MONEY**

**Easily Handled
No Wires
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**No harm done if
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**Write
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COMPLETE
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8,000 Candle Power without extension;
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Carbide Lantern.
Brilliant rear signal
of red blue or
green. Ideal for
emergencies

Use National Carbide in the Red Drum

NATIONAL CARBIDE CORP.

LINCOLN BUILDING

NEW YORK

DUST PREVENTION

is the Beginning of

ROAD IMPROVEMENT

PUBLIC demand for dust prevention should not be considered unreasonable. Everybody knows that a dusty road or street is rapidly losing its surface material, that loose surfaces need binding to hold them in place and that such binding may be supplied by surface treatment with calcium chloride. When residents demand abatement of the dust nuisance, meeting that demand is real economy, if you use calcium chloride, the clean odorless dust-layer.

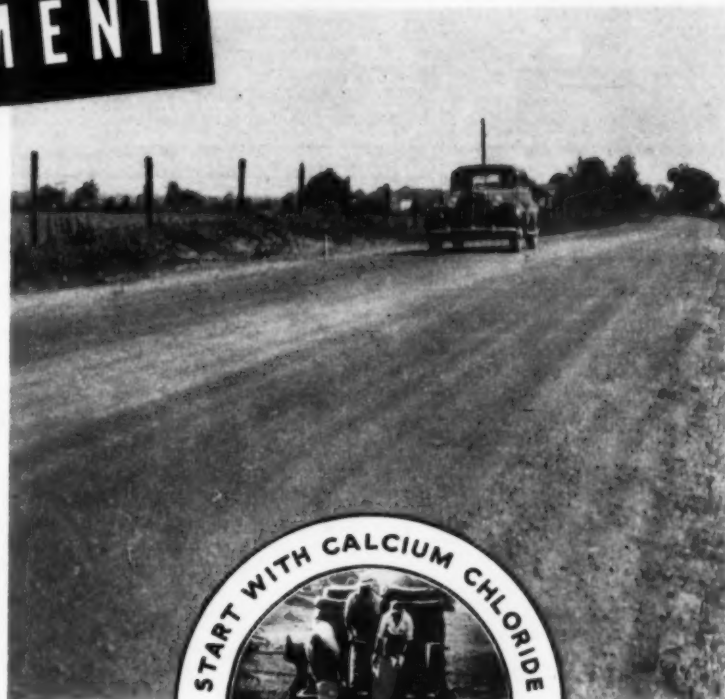
While gravel and stone roads are under maintenance as open surfaces, calcium chloride treatment makes the difference between success and failure, since even the best possible soil-aggregate mixture will disintegrate under traffic unless a favorable moisture content is maintained. It is best maintained with calcium chloride at such saving of material and labor, that the dust-proofing really costs little or nothing.

If road funds do not permit meeting all demands for dustproofing, arrangements are frequently made for residents to pay half, or for residents to purchase the calcium chloride to be applied without cost by highway departments. In many cases of limited budgets, arrangements are made for surface application in spots where dust is particularly offensive and dangerous, such as street intersections, bridge approaches, curves and in front of dwellings. By this spot treatment method, costs may be kept at a minimum.

Where roads or streets contain proper aggregates with binder soil, maintenance with calcium chloride is the beginning of more permanent improvement. In others, yearly additions of aggregates and binder soil mixed with calcium chloride will develop well compacted stabilized wearing courses, which when maintained annually with calcium chloride, provide dustless, stable all-year roads at very low cost. Write for literature explaining these successive steps in road improvement.

CALCIUM CHLORIDE ASSOCIATION
4145 PENOBSHOT BLDG. • DETROIT, MICHIGAN

**CALCIUM
CHLORIDE**
TO IMPROVE
ROADS AND STREETS



FIND OUT HOW—USE THIS COUPON

Write for literature describing methods of road improvement with local soils and Calcium Chloride.

CALCIUM CHLORIDE ASSOCIATION, 4145 Penobscot Bldg., Detroit, Mich.

Please send literature describing:

☐ Dustproofing ☐ Surface Consolidation ☐ Stabilized Roads

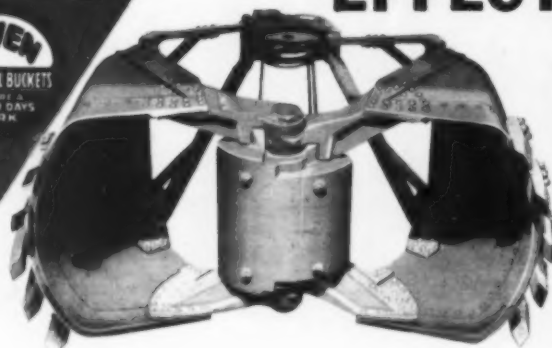
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GETS
A
MOUTHFUL
AT EVERY
BITE



a ROUND NOSE for MORE EFFECTIVE DIGGING



The Type DX bucket has exceptional strength and digging ability. The centers of the lips penetrate with minimum resistance and continue to carve their way into the hard material, assuring a greater load at each grab. There are no corners or square back plates to retard the entrance of material.

THE OWEN BUCKET CO.

6020 Breakwater Ave.
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Branches: New York, Philadelphia,
Chicago, Berkeley, Cal.

With Buyers of Shovels it's ABW!

SINCE
1774



The Famous
Ames Bend gives
perfect balance.



The ABW Shock
Band makes
handle stronger.



Die Pressed La-
bels which cannot
come off or be-
come mutilated.

There are more ABW Shovels sold than any other make. Year in and year out, from the Miner who buys his own shovel to the big buyer of shovels, this preference is sustained. The reason for this is obvious when you consider that for one hundred and sixty-four years "Ames" Shovels have been the leaders. And look at the revolutionary and exclusive features which distinguish ABW Shovels.

The prestige of a firm is reflected in its product. When you buy ABW Shovels you can feel secure that you are getting the best in design, materials and workmanship—the result of one hundred and sixty-four years of shovel making experience.

Ask Your Jobber

AMES BALDWIN WYOMING CO.
Parkersburg, W. VA. • North Easton, Mass.
SHOVELS • SPADES • SCOOPS • FORKS • HOES • RAKES
POST HOLE DIGGERS • AGRICULTURAL HANDLES

The Famous Ar-
mour-D Handle—
there is no wobble
to an Armour-D.



Electric welded
front straps on
plain backs which
are tear proof.



The finest of
shovel steel made
by a special con-
tinuous rolling
process feature
ABW Shovels.



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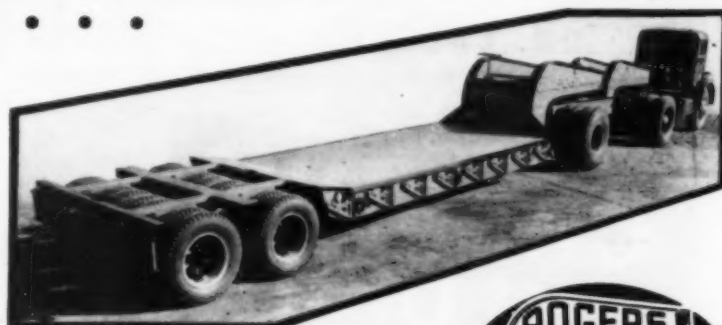
PERFORMANCE . . .

• Rogers Trailers embody the three features vital to satisfactory performance—

1. Quick, easy **LOADABILITY** due to low construction—
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3. Safe, dependable **BRAKEABILITY** under all conditions in the new equalizing brake system.

For the utmost in proven design and value, investi-
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ROGERS BROTHERS CORPORATION, 220 Orchard St., Albion, Pa.



EXPERIENCE built it . . .
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Completely **ELECTRICALLY WELDED** to combine **LIGHTNESS** with **STRENGTH**

*There are reasons
for specifying*

ADNUN

TRADE MARK REGISTERED

**BLACK TOP
PAVER**

**Continuous Course
Correction**

Maintains cutter bar on a practically level plane regardless of front wheel deflection when surfacing over uneven subgrade. This feature assures a smooth, even road contour. Invaluable when retopping old macadam or brick.

Power Cut-Off

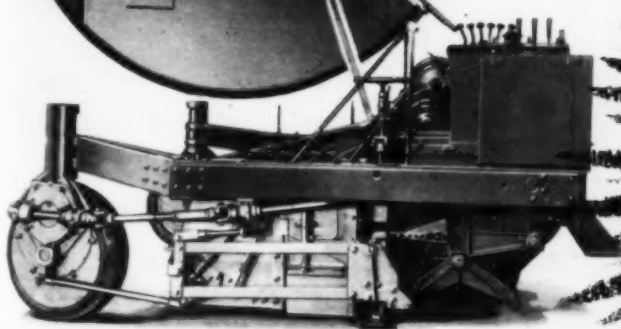
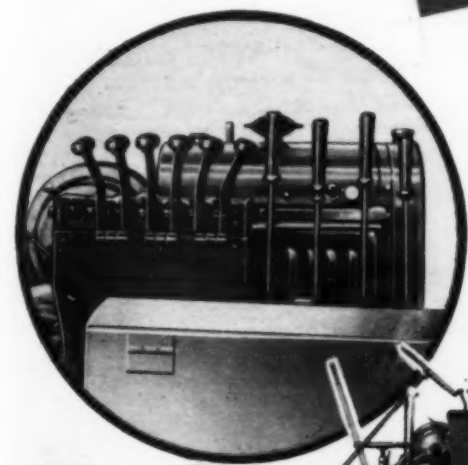
Cuts off material flow at any desired time. No tag end drip or time and labor spent in digging up runouts. Permits carrying load across intersection and continuing spread.

Overlapping Cutter Bar

Provides a positive strike off that assures desired material contour and thickness. Abuts a curb with little or no raking. Lays a joint that cannot be detected, and is designed to press material into holes or rifts in the subgrade.

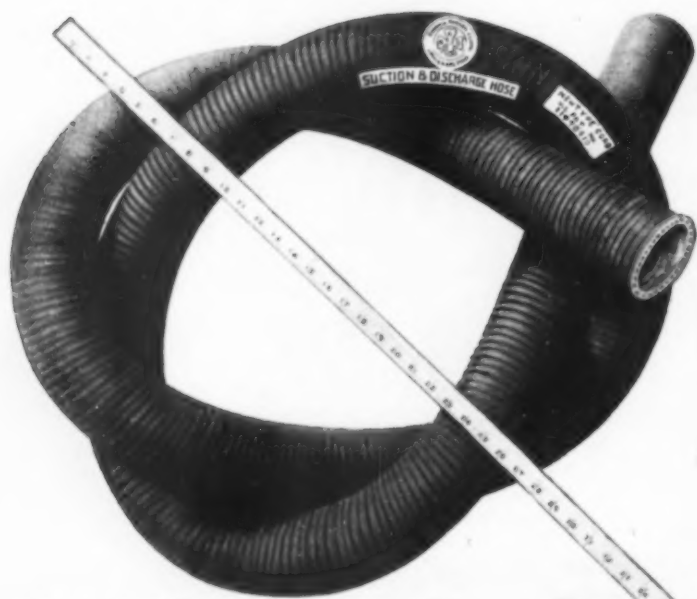
End Gates

End gates may be lifted mechanically to allow material delivery to widths over 10 ft.



**+
HYDRAULIC
CONTROLS**

THE FOOTE CO., INC.
Nunda, New York



Tie *This* for Flexibility!

Extreme Pliancy is Only ONE
of the Cost-Saving Features of

GOODALL

"NEWTYPED CORD"

(U. S. Pat. No. 1948410)

SUCTION and DISCHARGE HOSE

Every characteristic of this dependable, two-purpose hose contributes to low-cost, trouble-free service. In addition to being extremely flexible it has the strength and durability to withstand the hardest kind of wear and abuse. Can be quickly rounded into shape with mallet after being run over or otherwise crushed, without damage to tube or carcass. Smooth bore, heavy elastic rubber tube resists destructive action of abrasives and insures rapid, unchecked flow. Light in weight and easy to handle . . . *the perfect hose for both suction and discharge pumping.*

. . . Stocked in all sizes up to and including 4", in maximum lengths of 50 feet. Other brands of GOODALL Suction Hose carried in sizes up to 12".

GOODALL RUBBER COMPANY

5 SOUTH 36th STREET • PHILADELPHIA, PA.

New York • Pittsburgh • Chicago • Cleveland • Houston

FACTORY: TRENTON, N. J.

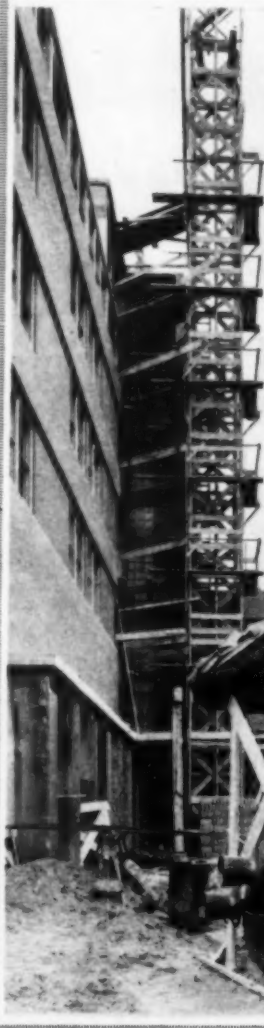
GOODALL MECHANICAL CORP.

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The originators of the
"Standard of Quality" Line
(Reg. U. S. Pat. Off.)
of contractors rubber goods







MODERN and PRACTICAL CLYDE GASOLINE HOISTS

Modern in the sense of using modern materials and design that gears them to meet modern demands for speed and economy. Practical to the extent of sound sturdy construction that permits many years of continuous and profitable service.

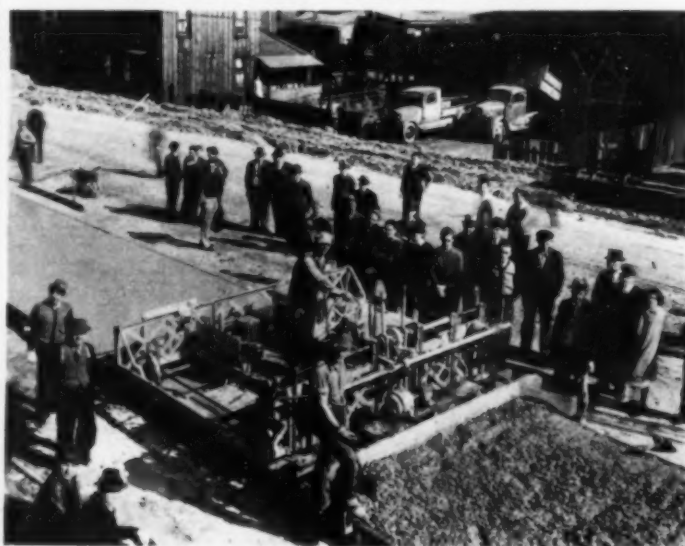
"You'll take Pride — in your Clyde"



CLYDE IRON WORKS, Inc.
DULUTH-MINN.



"SPEED — PROFIT SATISFACTION"



"FLEX-PLANE" finishing machines are causing sensations wherever they go. Nothing can equal the quality of the work done by the "FLEX-PLANE" wide screed.

FLEXIBLE ROAD JOINT MACHINE CO.
WARREN, OHIO

**to Easily Handle
double paver
output**

**use a
BLAW-KNOX
GAS-ELECTRIC
ROAD FINISHER**

To get real profitable production and high quality work on any paving job—concrete or bituminous—use the Blaw-Knox Gas-Electric Road Finisher. It easily handles the output of two 27-E Pavers, dual drum pavers, and the newer largest size paving mixers.

Investigate the advantages of the Blaw-Knox gas-electric principle—its convenience and speed of operation and its enormous capacity for yardage of slab which has been conclusively demonstrated in service under a great variety of paving conditions.

Some of the advantages of the Blaw-Knox Gas-Electric Road Finisher are:
Rapid and easy adjustment of width.
More positive and smoother power and traction.
Greater accuracy of steering on the forms.
Easier on the road forms.
Faster, greater flexibility of speeds.
Removable flanges on traction wheels, for quick wheel changes.

Vibrator for joints can be plugged in on the finisher, eliminating the need of a separate generator.
Smoother and truer finish of slab.

If you wish further details of the Blaw-Knox Gas-Electric Road Finisher, send for Blaw-Knox Catalog No. 1507.

BLAW-KNOX DIVISION
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*What Helps
Business
Helps You!*

*Investigate
the advantages*



of Buckeye DITCHERS with

*Shiftable
Booms*

MODEL 120

Here is a ditcher that digs ditch where you want it—regardless of obstructions along the right-of-way. Gets close to buildings, poles, curbs. Maneuvers neatly in close quarters. Digs trench 16 in. to 30 in. wide and to 11½ ft. deep. Powered for tough going, and makes fast work when the going is easy

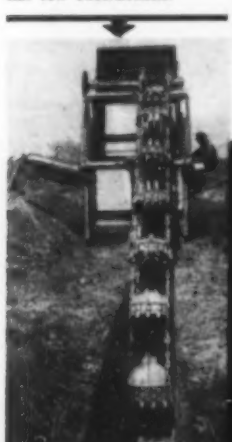
MODEL 160

Not many ditching jobs come outside the range of this machine. Bigger, more powerful, than the 120, it digs trench from 16 in. to 42 in. wide and to 12½ ft. deep. An extra attachment for digging trench to 60 in. wide and 6 ft. deep. No soil condition too tough for this ditcher. Digs 75% of all ditching jobs—profitably.

Digs in any intermediate position. Set the boom where you want it. Dig forward or in reverse—tunnel under sidewalks, dig manholes, etc., saves days of hand labor.

Dig to the right. Puts trench within 10 in. of poles or similar high obstructions.

Dig to the left. Puts trench within 4 in. of curb or similar low obstructions.



**BID THE
Buckeye
WAY**
ask for our
operation data
before you
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THE BUCKEYE TRACTION DITCHER COMPANY
FINDLAY, OHIO

THE BUCKEYE TRACTION DITCHER CO., FINDLAY, OHIO

Send data and prices at once.

- ☐ MODEL 120 DITCHER
☐ MODEL 160 DITCHER
☐ SEND A SALES ENGINEER

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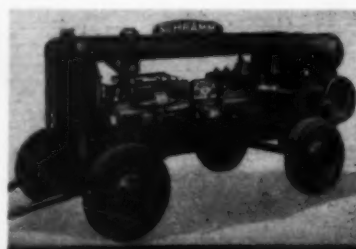
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modern SCHRAMM Utility COMPRESSORS save money

BECAUSE... LIGHTWEIGHT costs less to move.
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BECAUSE... engine speed is at maximum economy.
BECAUSE... modern design features insure long life.
BECAUSE... there is a size and type to FIT your job.



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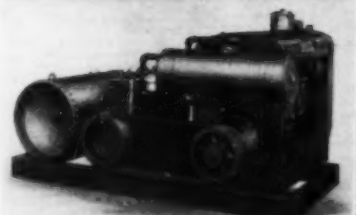
Motor Truck Mounting



Less Running Gear



"Utility Jr." Model 18



Stationary Engine Drive

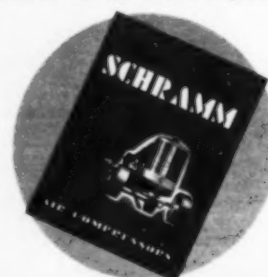


Stationary Motor Drive

Every SCHRAMM "Utility" COMPRESSOR contains identical design principles and features. Sizes from 18 to 420 cu.ft. actual air delivery—and a wide selection of mountings suited for your job.

FOR YOUR FILE

Write for Bulletin 3700-MM that shows details of construction, the money saving design features, with many illustrations and complete specifications. Learn the facts about THE WORLD'S MOST MODERN AIR COMPRESSOR.



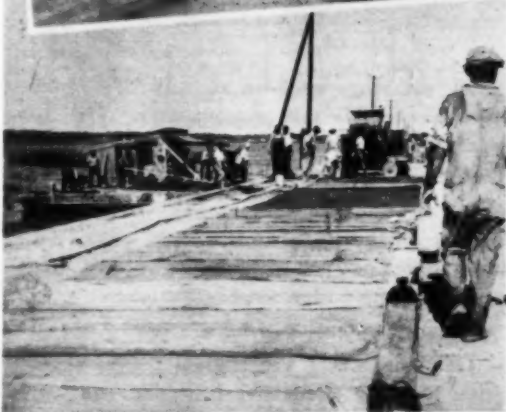
SCHRAMM, INC.,—WEST CHESTER, PA.

OLD SPANISH TRAIL, U.S. Route No. 90, West of Pascagoula, Jackson County, Miss. Reconstruction was by Jackson County day labor under the direction of L. C. Winterton, Consulting Engineer, Pascagoula, Miss.

Through Marsh Land Detour - Impossible



Quick Service Concrete took traffic load in 24 hours



**LEHIGH EARLY
STRENGTH CEMENT**

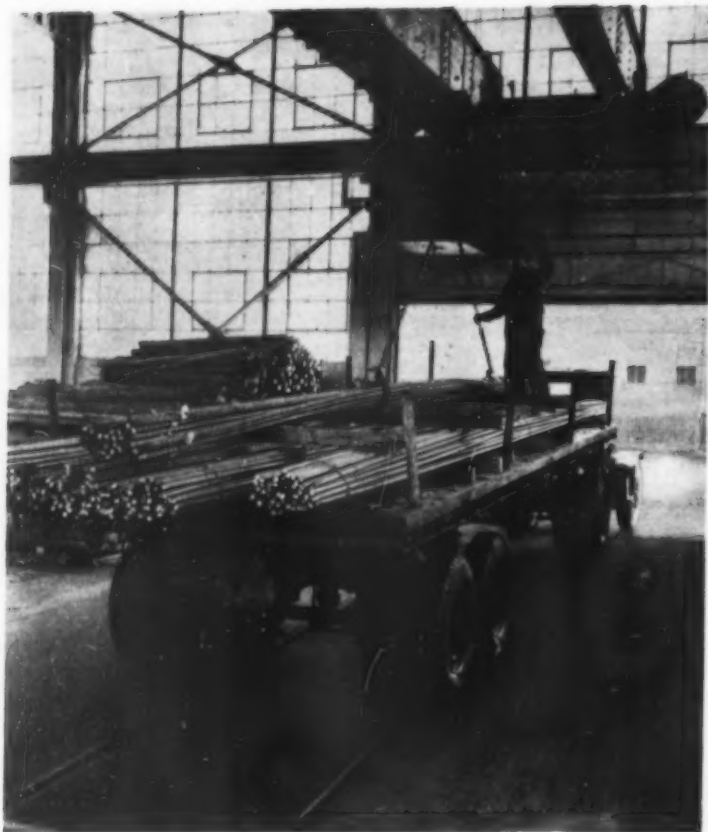
FOR unusual and difficult engineering construction, quick service concrete gives valuable help. Typical of its adaptability and economy was its use in building a new 20 foot wide concrete road across tidewater marshes on the old Spanish trail in Mississippi.

Across the marshes, there was no available detour. The causeway was not wide enough to provide a temporary roadway, nor storage space for materials which were delivered by barge. Yet it was imperative that traffic be maintained.

Using Lehigh Early Strength Cement, the pavement was built one lane at a time and one way traffic was handled by two flagmen. Each day 500 feet of one lane were closed, prepared and poured. The next morning it was opened to traffic and the operation repeated on the adjacent 500 foot stretch. Quick service concrete facilitated the entire project, and helped overcome the difficulties and inconveniences of the unusual conditions of the job. Quick completion reduced overhead expenses, the expense of flagmen, and avoided a long period of traffic delays on the "heaviest travelled road in the State of Mississippi.

Compared with normal portland cement, Lehigh Early Strength Cement makes better, denser concrete that cures to service strength three to five times faster. Use it wherever speed is vital or where economies will result. Consult the Lehigh Service Department for specific data.

LEHIGH PORTLAND CEMENT COMPANY
Allentown, Pa. Chicago, Ill. Spokane, Wash.



***For quick deliveries
of reinforcing bars
...order from
Bethlehem warehouses***

When you need reinforcing bars in a hurry, whether your requirements are large or small, you can count on Bethlehem for prompt deliveries. Warehouse stocks in key cities throughout the country are at all times adequate to meet any demands. Your order is sped on its way, insuring against costly delay of your work from steel not being on hand when needed.

Our Reinforcing Bars have the uniform, evenly spaced deformations that make for excellent concreting qualities. They can be supplied plain, deformed or special in squares or rounds.

A 'phone call or a postcard to the Bethlehem district office nearest you will bring you detailed information on Bethlehem's warehouse service.

BETHLEHEM STEEL COMPANY, General Offices: Bethlehem, Pa., District Offices: Albany, Atlanta, Baltimore, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Honolulu, Houston, Indianapolis, Kansas City, Mo., Los Angeles, Milwaukee, New Haven, New York, Philadelphia, Pittsburgh, Portland, Ore., Salt Lake City, San Antonio, San Francisco, St. Louis, St. Paul, Seattle, Syracuse, Toledo, Washington, Wilkes-Barre, York. Export Distributor: Bethlehem Steel Export Corporation, New York.

**BETHLEHEM STEEL
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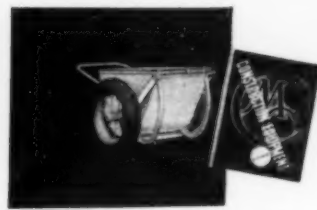
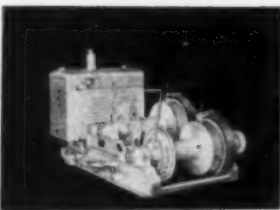
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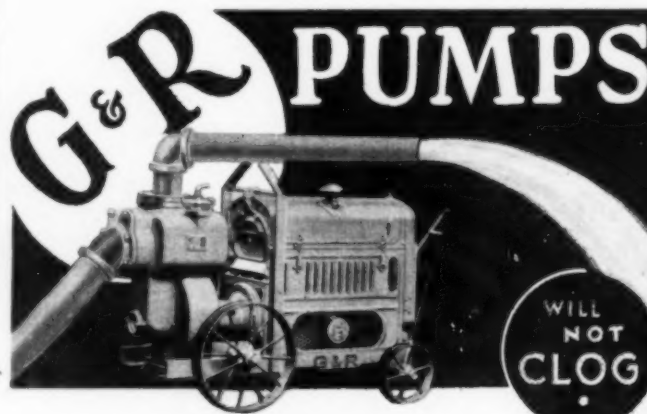
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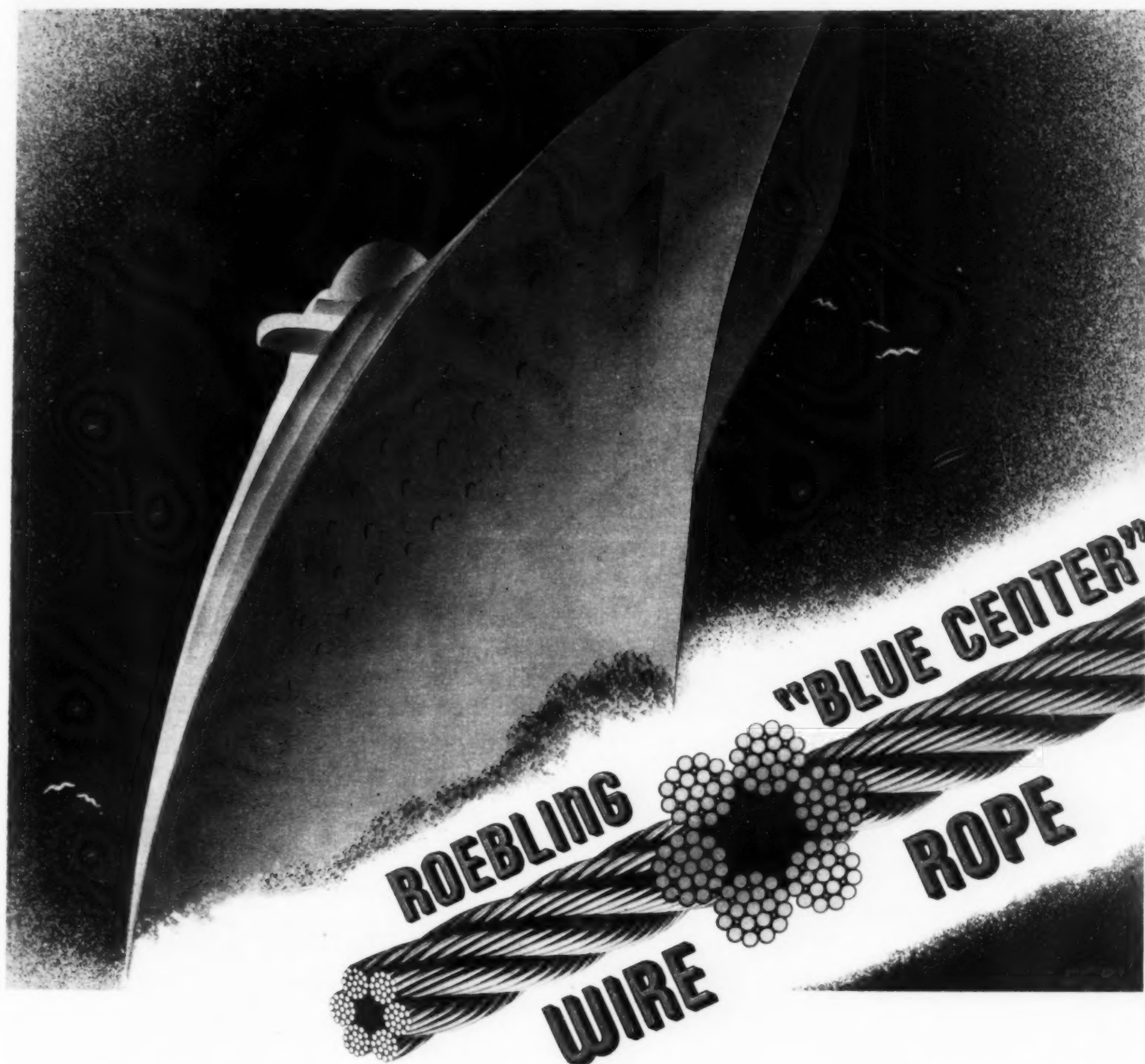
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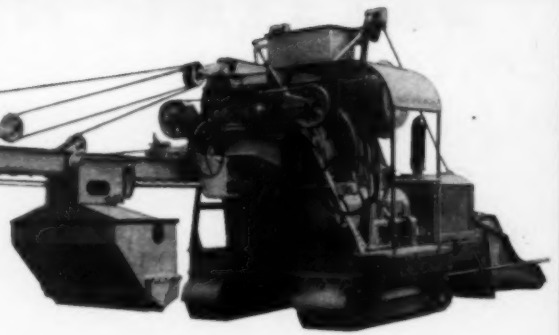
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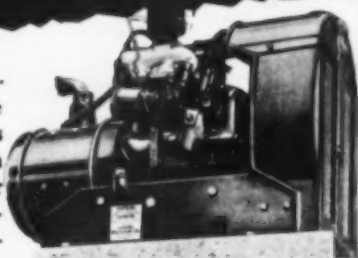


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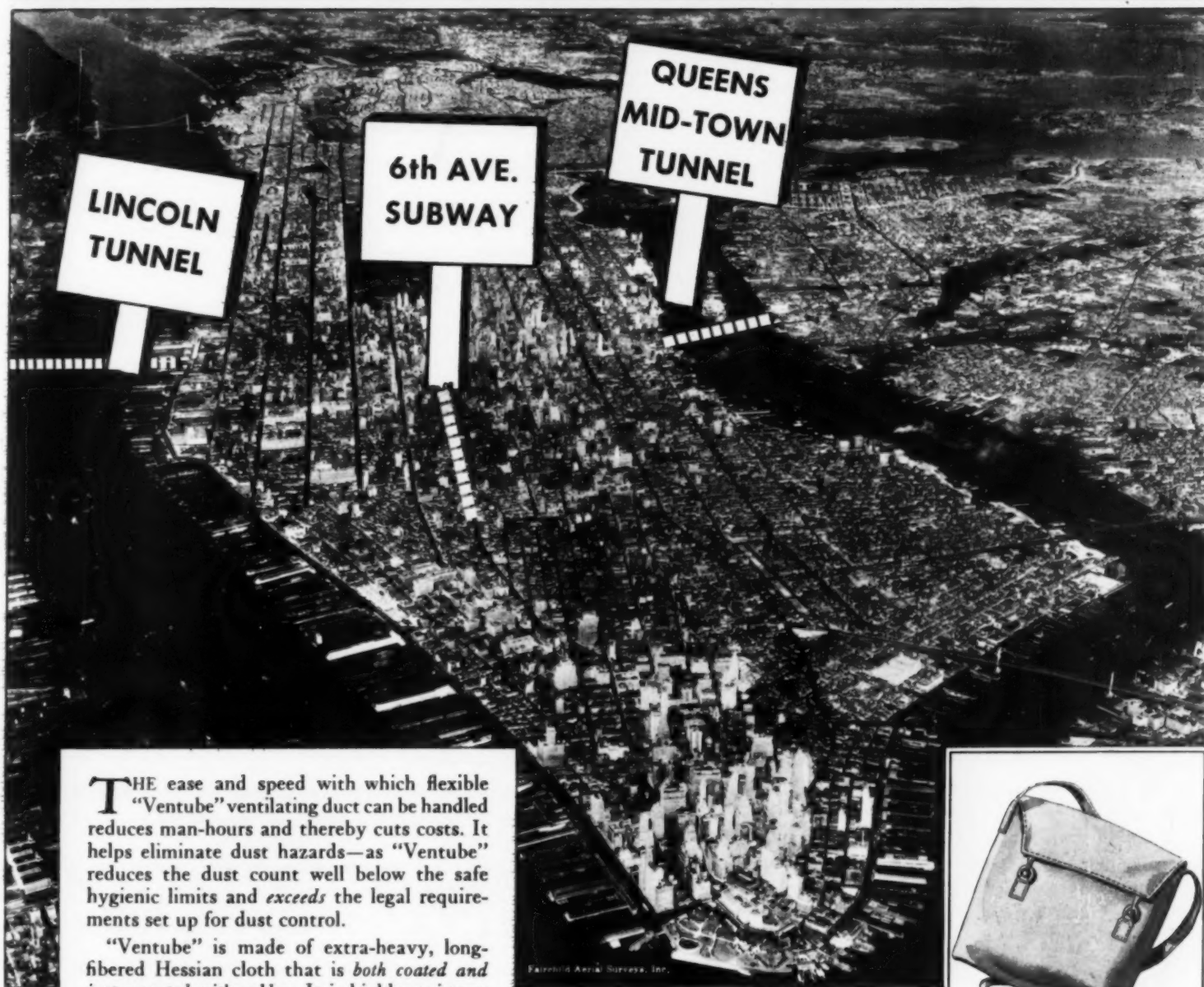
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THE FLEXIBLE VENTILATING DUCT
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separate charges and reduces the time of loading holes and connecting up preparatory to making the shot.

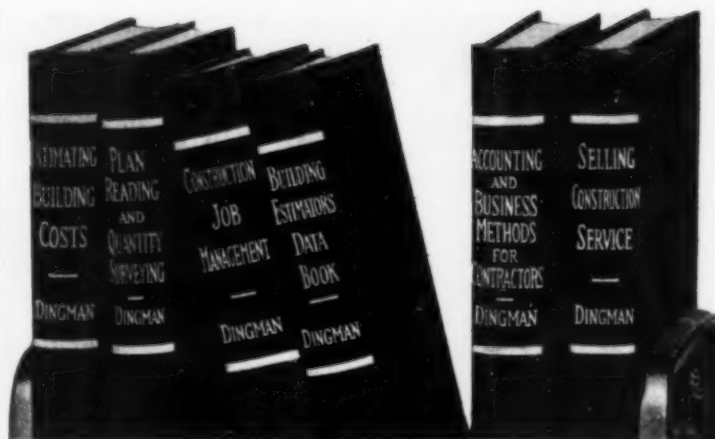
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Detonating Fuse

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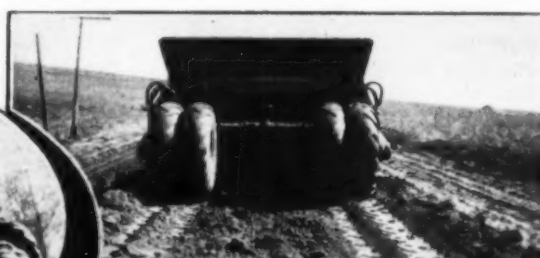
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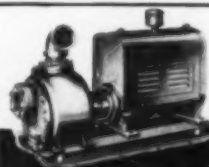
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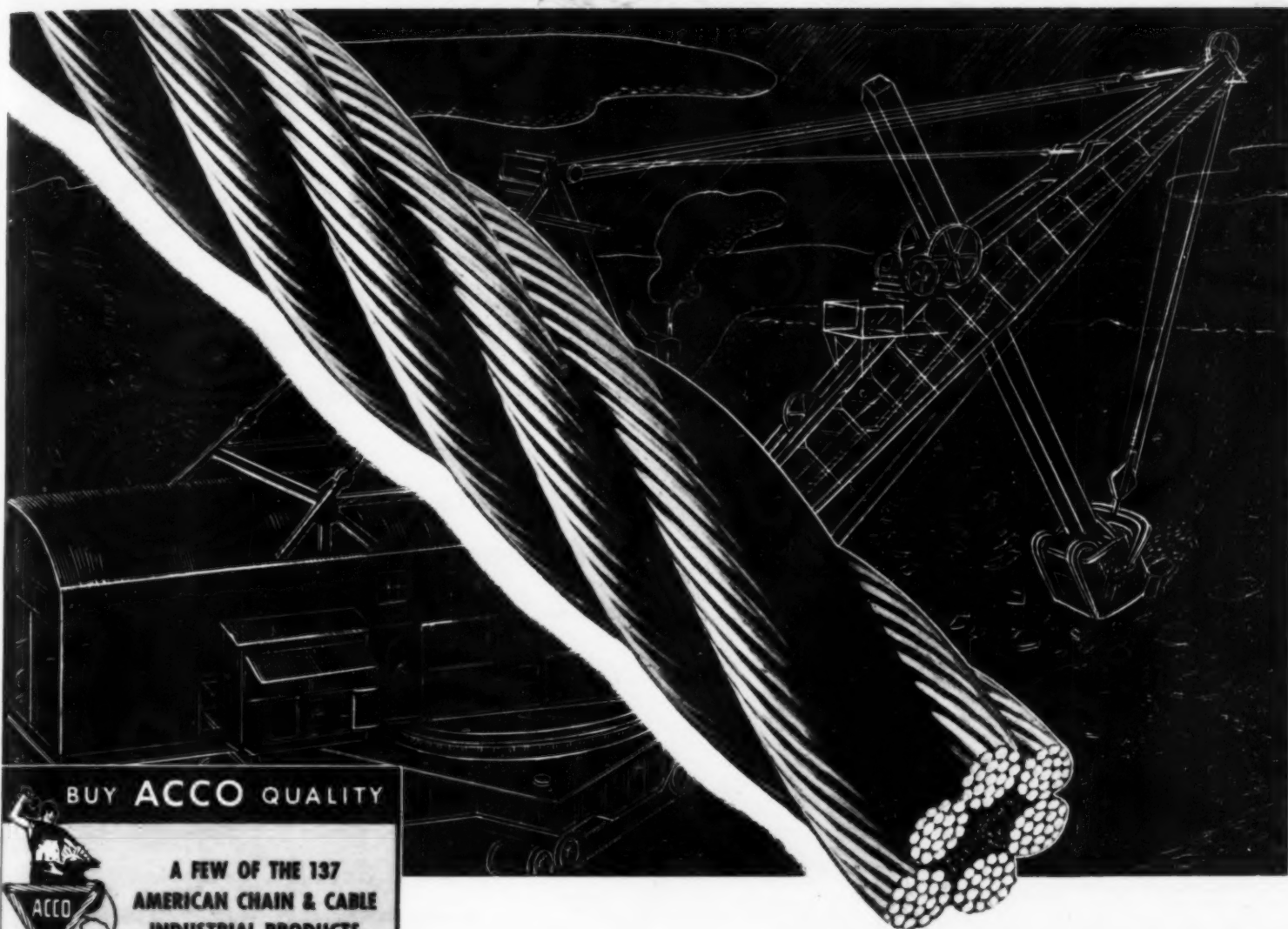
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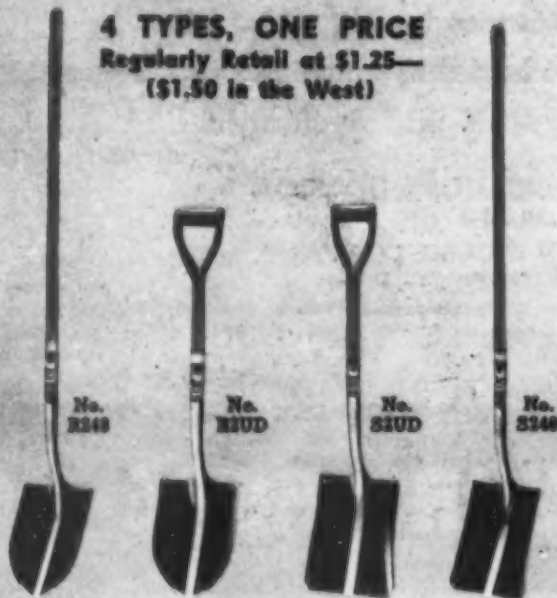
CROSS SECTION AT THE FROG

Note in cross section above how the thick backbone stiffens and enormously strengthens the frog, where in ordinary shovels 9 out of 10 failures occur. Note in cross section below how the backbone reinforces, adds life at the cutting edge, where all shovels eventually wear.

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